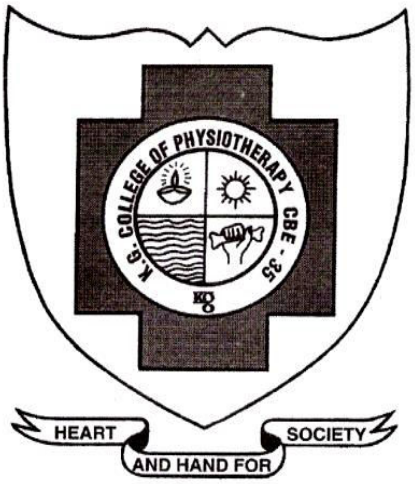
"EFFECT OF MUSCLE ENERGY TECHNIQUE AND CONSERVATIVE EXERCISES ON PAIN, RANGE OF MOTION AND SHOULDER FUNCTION IN PATIENTS WITH ADHESIVE CAPSULITIS"



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A DISSERTATION SUBMITTED TO THE TAMILNADU

DR. M. G. R MEDICAL UNIVERSITY, CHENNAI.

AS PARTIAL FULFILLMENT OF THE

MASTER OF PHYSIOTHERAPY DEGREE

APRIL 2016

CERTIFICATE

Certified that this is the bonafide work of **Mr GOPINATH** of K.G. College of Physiotherapy, Coimbatore, submitted in partial fulfillment of the requirements for the Master of Physiotherapy degree course from the Tamilnadu Dr. M.G.R. Medical University under the **Registration No: 271410301** for the April 2016 Examination.

Principal

Place : Coimbatore

Date :

"EFFECT OF MUSCLE ENERGY TECHNIQUE AND CONSERVATIVE EXERCISES ON PAIN, RANGE OF MOTION AND SHOULDER FUNCTION IN PATIENTS WITH ADHESIVE CAPSULITIS"

Under the guidance of,

Guide: _

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_____ _____

Internal Examiner **External Examiner**

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I.INTRODUCTION

The shoulder is a unique anatomical structure with an extraordinary range of motion (ROM) that allows us to interact with our environment. A loss of mobility of this joint will cause significant morbidity. Frozen shoulder or Adhesive capsulitis or shoulder Periarthritis affects 2—5% of the population and is most common in the 40-60 year old age group. (Jalena Jurgel et al., 2005). Nevasier was the first person who identifies the pathological and histological examination of the frozen shoulder and concludes that it is not a periarthritis where as there is a thickening and contraction of the capsule is seen, which becomes adherent to the humeral head and he termed is as Adhesive capsulitis. (Nevasier, 1945).

Shoulder pain initially was described as "periarthritis" which was described by Duplay in 1872. Later it was termed as "Frozen shoulder" where there is gradually developing condition, characterized by pain, restricted movements and painful movement and disability to sleep on affected side. (Codman, 1934). Nevasier defined this shoulder pain as the "Adhesive capsulitis" since there were inflammatory pathogenesis and fibrosis around the shoulder joint capsule. (Nevaiser 1945). Histological studies has confirmed the presence of fibroblasts and chronic inflammatory cells which seen in joint capsule of the shoulder. (Hand et al., 2007).

Women are more frequently affected than men approximately 70% of women are affected. (Sheridan et al., 2006). Bilateral involvement occurs in 10-40% cases. The incidence of adhesive capsulitis in people with diabetes is up to 20%. (Kulkarni 1999). Adhesive capsulitis is a condition of the shoulder of unknown etiology. Predisposing factor includes secondary trauma, post surgery, cardiovascular disease and diabetes. (Matsen et al., 1993). There are some evidences that protease inhibitors used in antiretroviral therapy have been associated with the development of Adhesive capsulitis. (Zuckerman et al., 2011).

Adhesive capsulitis has been classified as primary and secondary. Primary adhesive capsulitis is characterized by global capsular inflammation and fibrosis which occurs without any precipitating cause. Secondary capsulitis includes much condition causing stiff shoulder such as calcific tendinopathy, glenohumeral arthritis, rotator cuff tear, acromioclavicular arthritis and previous shoulder trauma or surgery. (Pearsall et al., 1998). Treatment for the adhesive capsulitis should be based on the disorder of have to sort out the primary cause of stiffness. (Noel et al., 2000).

Adhesive capsulitis describes three clinical stages. 1) Freezing stage, characterized by acute and continuous pain and arm stiffness in adduction and internal rotation. 2) Frozen stage during which there is less pain but more of stiffness 3) Thawing stage during which well being and movement are slowly and

gradually restored. Even though this disease has a benign course, its symptoms can sometimes persist for a long time, possibly leading to functional damage of the shoulder griddle and general shoulder disability. (Donatelli, 2012).

Adhesive capsulitis is characterized by the spontaneous onset of pain, Pain located on the antero-lateral aspect of the joint and rarely radiates to the anterior aspect of the upper arm. Discomfort is worse at night and it interferes with sleep. Palpable tenderness is noticed over the humeral head and over the bicepital groove. Movements are limited in all directions, restrictions of movement are seen in active and passive range with which effects the entire upper limb. (Boyle-Walker 1997, Peter et al., 2003, Harryman et al., 2004). Most common limitation of the range of motion is flexion, abduction, and external rotation. Loyd (1983) suggested that secondary frozen shoulder develops when painful spasm limits activity and creates dependency of the arm.

Adhesive capsulitis cause limitation or selective immobilization in the shoulder movement. Prolonged immobilization of the joint has been shown to cause several detrimental pathophysiologic findings which include decrease collagen length, fibrofatty infiltration into the capsular recess, ligament atrophy result in decreased stress absorption, collagen band bridging across recesses, random collagen production and altered sarcomere number in muscle tissues. (Mangine et al., 1994).

Adhesive capsulitis is a commonly recognized but poorly understood cause of a painful and stiff shoulder. Although most orthopaedic literature supports treatment with physical therapy and stretching exercises, some studies have demonstrated late pain and functional deficits.

Adhesive capsulitis are treated conservatively using physiotherapy alone or physiotherapy in combination with steroids which helps to resolve symptoms in 3—4 months. (Levine et al., 2007). Physiotherapy are measured as the key to the treatment for the adhesive capsulitis and treatment includes ultrasound, Ice pack, Range of motion exercises and eventually strengthening exercises. (Melzer et al., 1995). Conservative physiotherapy for adhesive capsulitis includes joint mobilization, stretching, strengthening exercises and Codman's pendulum exercises.

Joint mobilization techniques like muscle energy technique, cyriax technique are considered to be good in the treatment for adhesive capuslitis. These manual therapy techniques can break up the scar tissues in the joint capsule. It is very important for the patient to undergo these techniques to reduce pain and improve range of motion. (McClure et al., 1997).

Codman's Pendulum exercises are techniques that use effects of gravity to distract the humerus from glenoid fossa. (Calliet 1991). Hence these are passive movements assisted by gravity. They help relieve pain through gentle traction and

oscillating movement and provide early motion of joint structures and synovial fluids. (Kisner 2002).

Muscle energy technique (MET) is a common soft tissue mobilization technique which involves the voluntary contraction of the subject's muscles in a precisely controlled direction, against a counterforce provided by the therapist. MET is used to decrease pain, stretch the tight tissues, reduce the tone, improve circulation, mobilize the joints and strengthen the weak musculatures. (Fryer et al., 2004). Muscle energy technique has show significant improvement for range of motion which was supported in various literatures. (Schenk et al, 1997). Another study done by Stephanie et al., 2011 concluded that MET for glenuohumeral joint helps to improve Glenohumeral joint range of motion.

Clinical measurement of range of motion is a fundamental evaluation procedure with ubiquitous application in physical therapy. The examination of shoulder mobility may be accomplished using a number of instruments including: visual observation, goniometry, linear measures, and inclinometry (Clarkson 2005). Goniometry has been used widely due to its portability and low cost.(Gajdoski et al., 1987). Clinicians should use a goniometer to take repeated PROM measurements of a patient's knee to minimize the error associated with these measurements. (Watkins et al., 1991).

Visual analogue scale (VAS) is a numerical scale which measures the pain of the individual. It is a 10cm line with one end marked as Zero(0) indicates no pain and other end with Ten (10)indicates intolerable pain or worst type of pain. (Wong et al., 1988). Studies show that VAS has high amount of reliability and validity and can be used as a measurement tool. (Ritter et al., 2006)

The Shoulder Pain and Disability Index (SPADI) is a self-report measure developed to evaluate patients with shoulder pathology. The shoulder pain and disability index (SPADI) is a self-report questionnaire developed to measure the pain and disability associated with shoulder pathology. The SPADI consists of 13 items in two subscales: pain (5 items) and disability (8 items). Validity was established by correlating SPADI total and subscale scores with shoulder range of motion (ROM). (Roach 1991).

Though there are many interventions prescribed in the management of adhesive shoulder, the evidences are still lacking or the results are controversial. First choice of the treatment is based on a rehabilitation therapy program that has to follow precise steps leading to functional recovery of the shoulder joint avoiding the need for surgery. (Donatelli,2012). So this study is done to find out the efficacy of the muscle energy techniques in addition to the Conservative exercises in adhesive capsulitis.

1.1 NEED FOR THE STUDY

Adhesive capsulitis is a condition affecting the glenohumeral joint characterized by pain and loss of active and passive joint mobility. It is generally primary or idiopathic and arises spontaneously in the absence of specific causes such as traumas, fractures, tendon injuries or dislocations, which are causes of secondary shoulder stiffness. The fibroblastic proliferative process involves the entire joint capsule, and the fact that anterior capsular release generally leads to resolution of the clinical picture has led to the suggestion that fibroplasia and contracture are two clearly distinct processes, and that joints stiffness might not be entirely related to capsular fibroplasia (Ryu et al., 2006).

Contracture is defined as shortening of connective tissue (ligaments, tendons, and cartilage) caused by excessive arthrofibrosis, immobilization, inactivation, adhesions, or excessive neuromuscular tone. (Ada et al., 2005).

Even though this disease has a benign course, its symptoms can sometimes persist for a long time, possibly leading to functional damage of the shoulder girdle and general disability. The treatment of first choice for adhesive capsulitis is based on a rehabilitation therapy program that has to follow precise steps leading to functional recovery of the shoulder joint, avoiding the need for surgery. Conservatively physiotherapy management includes a variety of interventions like heat or ice applications, ultrasound therapy, interferential therapy, transcutaneous

electrical nerve stimulation, active and passive range of motion (ROM) exercises, Proprioceptive neuromuscular facilitation techniques and mobilization techniques. (Vermeulen et al., 2006).

Still there is no consensus regarding the best treatment for adhesive capsulitis. Although many different conservative measures were taken part, still there is no well treatment addressed. The recognition of the clinical stage must be the one which address the kind of the treatment. Implementation of muscle energy techniques along with Conservative therapy, demonstrated a significant decrease in pain and improved ROM and functional disability which supports the alternate hypothesis. (Lokesh et al., 2015).

Although there are many studies evaluated the efficacy of various treatment, only few studies are done to evaluate the effect of muscle energy technique and Conservative exercises in adhesive capsulitis. This study aims to address the problem.

1.2 AIM OF THE STUDY

- The aim of the study is to find out the effect of Muscle energy technique and conservative exercises on pain, range of motion and shoulder function in adhesive capsulitis.

1.3 OBJECTIVES

- To find out the effect of Muscle energy technique on pain, range of motion and shoulder function in adhesive capsulitis pain
- To find out the effect of Conservative exercises on pain, range of motion and shoulder function in adhesive capsulitis
- To compare the effect of Muscle energy technique and Conservative exercises on pain, range of motion and shoulder function in adhesive capsulitis

1.4HYPOTHESIS

Null Hypothesis

- There is no significant difference between Muscle energy technique and conservative exercises on pain, range of motion and shoulder function in adhesive capsulitis

Alternate Hypothesis

- There is a significant difference between Muscle energy technique and conservative exercises on pain, range of motion and shoulder function in adhesive capsulitis

II REVIEW OF LITERATURE

Catherine et al., (2011)

Stated that the Shoulder Pain and Disability Index is a valid measure to assess pain and disability in people with shoulder pain.

Boonstra et al.,(2008)

Conducted a study to determine the reliability and validity of the Visual Analogue Scale for disability in patients with chronic musculoskeletal pain and they concluded the reliability of the visual analog scale for disability is moderate to good and a strong correlation with the visual analog scale for pain.

Yang (2007)

Stated that mobilization had a positive effect in improving joint mobility and daily function in person with frozen shoulder.

Mac Dermid et al.,(2006)

Stated that internal consistencies of the shoulder pain and disability index subscales were high. It was found that the shoulder pain and disability index is a valid measure to assess pain and disability in shoulder pain due to musculoskeletal pathology.

Ritter et al., (2006)

Found that the Visual Analogue Scale is a valid measure as it was successful for measuring the underlying pain variable, and easier to use and code and sensitive to change in pain

Dias et al.,(2005)

Stated that adhesive capsulitis is more common in females and the peak age in 56 years. The natural course of the disease is divided into three phases which may not be clearly separated from each other: Painful freezing phase (10-36 weeks), adhesive phase (4-12 months) and resolution phase (12-42 months).

Seymore et al.,(2004)

Stated that visual analogue scale has found to be reliable and sensitive tool for measuring pain with high test-retest reliability.

Ong and Seymour et al.,(2004)

Suggested that visual Analogue Scale has been found to be a reliable and sensitive tool for measuring pain with high-test retest reliability.

Gould et al., (2003)

Stated that the Visual Analogue Scale is a measurement instrument that measures the intensity of pain in a significant way.

Fitz Patrick et al.,(2003)

Stated that adhesive capsulitis is caused by inflammation of the joint capsule and synovium that eventually results in the formation of capsular contractures. Clinically there is global loss of both active and passive range of motion of the glenohumeral joint with external rotation being the most restricted physiological movement, thus leading to functional limitation.

Dalton et al., (2003)

Stated that adhesive capsulitis is a disabling and painful condition characterized by the active and passive limitation of the shoulder range of motion (ROM). Shoulder motion and daily activities are restricted gradually, causing disability. Primary adhesive capsulitis is characterized by idiopathic fibrosis of the joint capsule. Secondary adhesive capsulitis occurs following some predisposing factors or seen together with some diseases. Female gender, age over 40 years, rotator cuff lesions, diabetes mellitus, thyroid diseases, stroke lung diseases, myocardial infarction, cervical spine disorders and reflex sympathetic dystrophy symdrome are the factors associated with adhesive capsulitis.

Wilson et al., (2003)

Muscle Energy Technique (MET) has been described as a valuable treatment technique because of many claimed therapeutic benefits resulting from a single procedure including lengthening and strengthening muscle, increasing fluid

mechanics and decreasing local edema, mobilizing restricted articulations and reducing pain and disability.

Kimberley Hayes et al (2001)

Conducted a study that the reliability of five methods for assessing shoulder range of motion with goniometry has inter-rater rho (0.64-0.69) and intra rater rho as 0.53-0.65 while assessing shoulder range of motion using goniometry.

Bijur et al, (2001)

Concluded that the Visual Analog Scale is a highly reliable instrument for measurement of acute pain.

Vermeulen et al., (2000)

Indicated that adherent axillary recess hinders humeral head mobility resulting in diminished mobility of the shoulder.

Sean and Griggs et al.,2000)

Stated that the Shoulder and Disability is a valid measure and more responsive than the sickness impact profile to asses pain and disability.

Philip Clure et al.,(2000)

Stated that there is a significant increase in active range of motion following passive mobilization in stiff shoulder.

Bang, et al., (2000)

Stated that the application of mobilization techniques optimized conditions for performing the strengthening exercise by reducing pain.

Strakowski et al.,(2000)

Stated that codman's exercises are those most frequently used to improve the range of motion. The emphasis in the therapy is on passive stretching of the shoulder capsular contracture in all planes of motion.

Myles et al.,(1999)

Stated that Visual Analogue Scale score is a linear scale changes in the visual analog scale score represents a relative change in the degree of pain sensation. Visual Analog Scale is comparative trials can help to quantify differences in patency and efficiency.

Mouliner et al., (1998)

Stated that high intensity mobilization significantly improved pain and passive range of motion.

Goodridge et al.,(1997)

Defined the muscle energy techniques are osteopathic procedures which are used to mobilize joints with limitation in movement, stretch tight muscle and fascia, improve local circulation and balance neuromuscular relationships to alter muscle tone

Williams et al., (1995)

Stated that shoulder pain and disability index (SPADI) is used to assess pain and routine functional skills of shoulder. A ten reduction in the score accurately distinguishes between people whose shoulder problems improve and those whose conditions remain stable and a ten-point gain distinguishes between people whose shoulder problems are unchanging and those whose problems are worsening.

Denslow et al., (1993)

Stated that effect of muscle energy technique may result from the inhibitory golgi tendon reflex, activated during the isometric contractions that leads to reflex relaxation of the muscle, as a result of post isometric relaxation (PIR).

Cox et al.,(1992)

The study on thirteen subjects keeping the pain tool as a Visual Analog Scale for self reporting of Subjective phenomena in the medical sciences and concluded that Visual Analogue Scale is valuable instrument fot the observation overtime for individual subjects.

Roach etal.,(1991)

Stated that a Shoulder Pain and Disability Index was developed to measure the pain and disability associated with shoulder pathology.

Howel ey al., (1988)

Stated that adhesive capsulitis is characterized by an insidious and progressive loss of active and passive mobility in glenohumeral joint presumably due to capsular contracture.

Dan et al., (1987)

Stated that incidence of frozen shoulder is slightly higher in women than in men and is somewhat more common in the non dominant arm. This condition most frequently affects persons aged 40-60 years.

Richard et al., (1987)

Conducted a study to review the related literature on the reliability and validity of goniometric measurements of the extremities. They concluded that clinicians should adopt standardized methods of testing and should interpret and report gonoiometric results as range of motion measurements only, not as measurements of factors that may affect range of motion.

Cyriax et al.,(1978)

Suggested that thickness in a joint capsule would result in a pattern of proportional motion restriction (a shoulder capsular pattern in which external rotation would be more limited than abduction, which would be more limited than internal rotation). Based on the absence of significant correlation between joint

space capacity and restricted range of motion contracted soft tissue around the shoulder may be related to restricted shoulder range of motion.

Codman (1934)

Stated that adhesive capsulitis is one of the most common and disabling orthopedic disorder characterized by painful restriction of shoulder motion for which patients seeks treatment.

Richard et al., (1986)

Stated that primary frozen shoulder is classically described as having three stages, “Freezing”, “Frozen” and Thawing”. Pain particularly in the first phase often keeps patients from performing activities of daily living (ADL). In the second phase, pain appears to be less pronounced but the restriction in active motion appears to limit the patient in personal care, activities of daily living (ADL), and occupational activities. In the third phase, there is increase in mobility, which leads to full or almost full recovery.

III METHODOLOGY

3.1 STUDY DESIGN:

Pre test and post test study design.

3.2 STUDY SETTING:

The study was conducted at the Department of physiotherapy, K.G Hospital, coimbatore.

3.3 STUDY POPULATION:

50 patients with shoulder pain who volunteered for the study were assigned for the assessment. A blinded assessor does the assessment and the patients were selected for the study based on strict selection criteria. 40 patients who fulfills the criteria of adhesive capsulitis were included in the study and they all be divided in to two equal groups.

3.4 STUDY DURATION:

The study was conducted for a period of one year. Individual subjects underwent treatment duration of six weeks.

3.5 SELECTION OF SAMPLES:

Total of 40 subjects were included for the study by using simple random sampling method.

3.6 SELECTION OF CRITERIA:

INCLUSIVE CRITERIA:

- Adhesive capsulitis patients with limited range of motion of shoulder.
- Age group of 40-60 years.
- Both male and female patients were included.
- Subjects with bilateral and/or unilateral adhesive Capsulitis.
- Subjects without type 2 diabetes mellitus.

EXCLUSIVE CRITERIA:

- Rotator cuff tears and other shoulder ligament injuries.
- History of any arthritis of shoulder.
- Reflex sympathetic dystrophy.
- Fracture in and around of shoulder joint.
- Reduced sensation.
- Malignancy.
- Peri-arthritis shoulder secondary to fracture
- dislocation
- neurological disorder

3.7 VARIABLES:

DEPENDENT VARIABLES:

- Pain
- Function
- Range of motion- Flexion, Extension, Abduction, Internal rotation and External rotation

INDEPENDENT VARIABLES:

- Muscle energy technique
- Conservative physiotherapy (Mobilization, Capsular stretches, Codman's Pendulum exercises, Pulley exercises).

3.8 PARAMETERS:

- Pain
- Function
- Range of motion- Flexion, Extension, Abduction, Internal rotation and External rotation.

3.9 OPERATIONAL TOOLS

- Visual analogue scale (VAS)
- Shoulder Pain and Disability Index (SPADI)
- Universal goniometer

3.10 PROCEDURE

40 patients with Adhesive capsulitis who fulfilled inclusion and exclusion criteria were selected and all the subjects were divided in to 2 groups, 20 subjects in each group. A clear explanation about the study was given to the selected patients who agreed to participate. Pain, function and range of motion measures are taken at the beginning of the first day and at the end of the second week of treatment.

GROUP A- MUSCLE ENERGY TECHNIQUE

- Muscle energy technique (Post isometric relaxation -PIS)
- Muscle energy technique is applied for 5 repetition per set, 5 sets per session, Each repetition is maintained for 10 seconds.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER FLEXION:

Therapist should stand infront of the patient and placed one hand over the top of the patient's involved shoulder at the superior part of the scapula and cup the glenohumeral joint to palpate for motion. The other hand and forearm support the patient's flexed elbow and flexed the humerus at the glenohumeral joint in the sagittal plane up to the initial point of resistance. The patients are directed to extend the elbow against equal counterforce applied by the therapist.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER EXTENSION:

Therapist should stand in front of the patients and placed one hand over the top of the patient's involved shoulder at the superior part of the scapula and cups the glenohumeral joint to palpate for motion. Place the other hand to support patient's flexed elbow and directed the patient to push the elbow anteriorly.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER ABDUCTION:

Therapist should stand in front of the patient, placed one hand over the top of patient's involved shoulder, cups the glenohumeral joint to palpate for motion and directed the patients to press the elbow towards their body.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER INTERNAL ROTATION:

Therapist should behind the patient. Carefully place the dorsum of the patient's hand of the involved side against the patients back. Therapist placed his one hand over the top of shoulder and superior part of the scapula and other palm protecting anterior side of the shoulder capsule and then placed his other hand, posterior to the patient's flexed elbow. Directed the patient to "press their elbow against his fingers.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER EXTERNAL ROTATION:

Therapist should stand behind the patient. Placed his hand superior to the patient's involved glenohumeral joint. Placed his forearm of the other hand medial to the patient's flexed forearm with his hand supporting the patient's hand and the wrist and then directed the patients to internally rotate the arm by pressing the hand.

Frequency of treatment:- One session per day, five days per week.

Treatment duration:- 6 weeks

GROUP B- CONSERVATIVE PHYSIOTHERAPY

- Mobilization:
    - Anterior glide
    - Posterior glide
    - Inferior glide
- Codman's pendulum exercises
- Pulley exercise
- Capsular stretches- Anterior capsule, Posterior capsule, Inferior capsule,

Hold the stretch for 30 seconds for each repetitions

.

STATISTICAL TOOLS:

Paired 't'- test

The intra group analysis of results were done with paired 't' test with 5 % level of significance. Statistical analysis is done using dependent ' t' test

$$t = \frac{\bar{d}}{S_d / \sqrt{n}}$$

$$s_d = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

Where,

d=difference between the pre-test Vs post-test

d=mean difference

n=number of observations

s=standard deviation

To compare experimental group and control group

Statistical analysis is done using independent 't' test

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}\right)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

Where,

S=Combined standard deviation.

S_1 and S_2= Standard deviation of experimental and control group respectively.

d_1 and d_2 = Difference between initial and final readings in control group and experimental group respectively.

n_1= No. of patients in control group

n_2== No. of patients in experimental group

X_1 and X_2 = Mean of control group and experimental group respectively.

TABLE -I

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF GROUP A - VISUAL ANALOGUE SCALE (Paired 't' test)

S.N	Group A	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	7.05	±5.85	0.83	24.01
2.	Post test	1.20		0.83	

The table I Analysis of VAS on paired 't' test. The 't' value for Group A was 24.01 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH-I

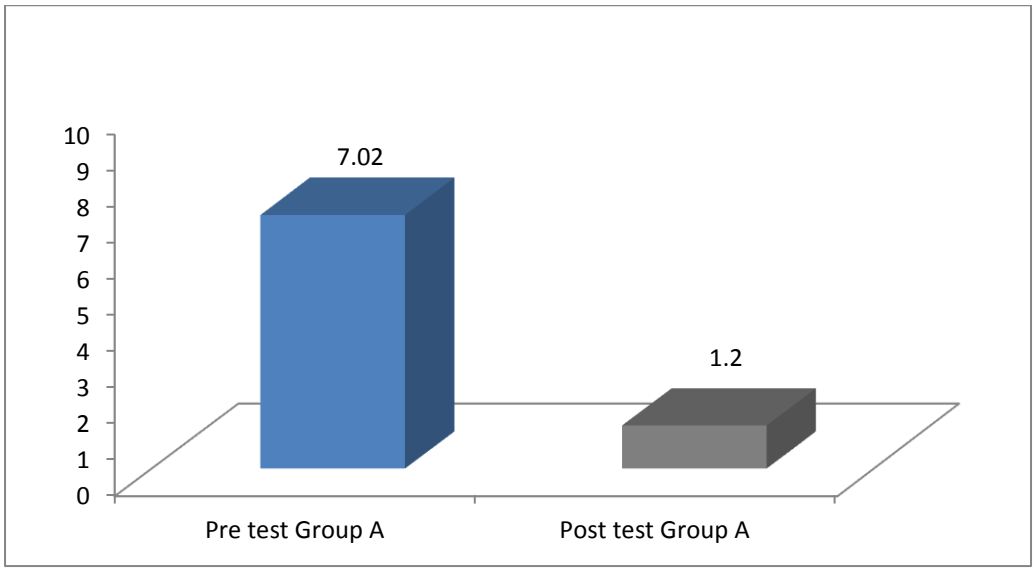

TABLE -II

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF GROUP B - VISUAL ANALOGUE SCALE (Paired 't' test)

S.N	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	6.85	± 3.15	0.81	16.09
2.	Post test	3.70		0.98	

The table II shows analysis of VAS on paired't' test. The't' test value for Group B was 16.09 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH-II

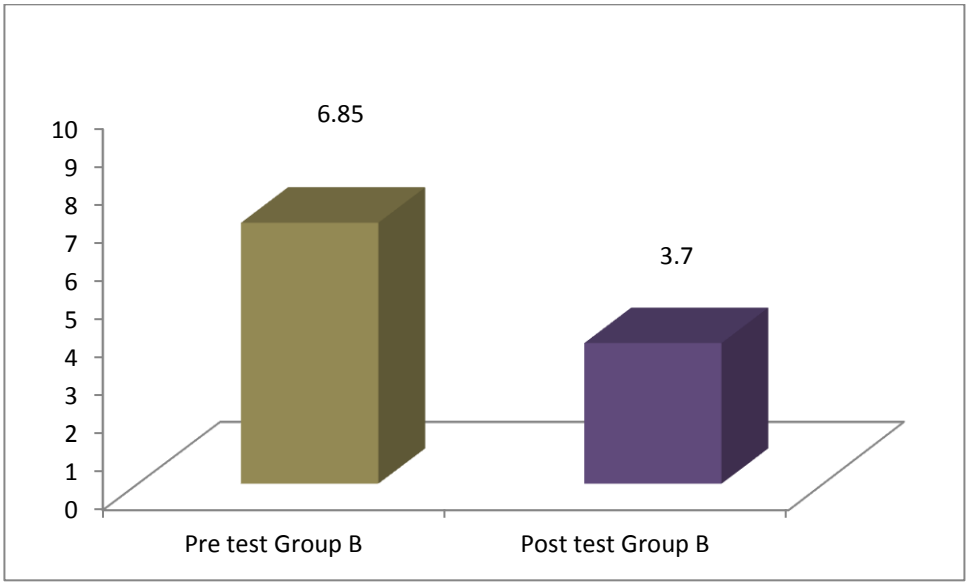

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TABLE -III

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF GROUP A - SPADI (Paired 't' test)

S.N	Group A	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	86.65	±74.15	5.89	60.62
2.	Post test	12.50		12.50	

The table III shows analysis of SPADI on paired 't' test. The 't' value for Group A was 60.62 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values

GRAPH -III

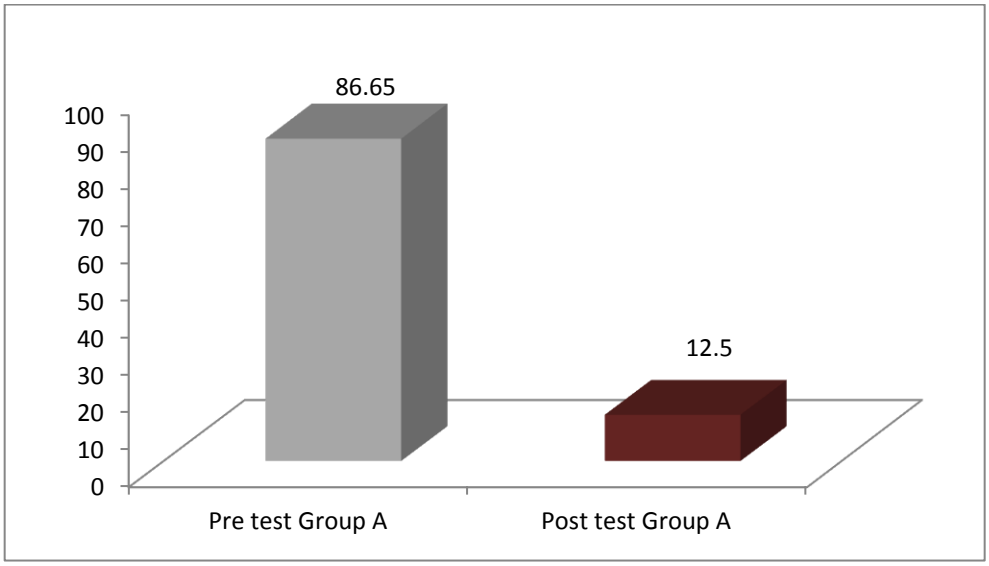


TABLE –IV

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF GROUP B - SPADI (Paired 't' test)

S.N	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	87.15	±51.15	6.70	24.76
2.	Post test	36.00		5.65	

The table IV shows analysis of SPADI on paired 't' test. The 't' value for Group B was 24.76 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –IV

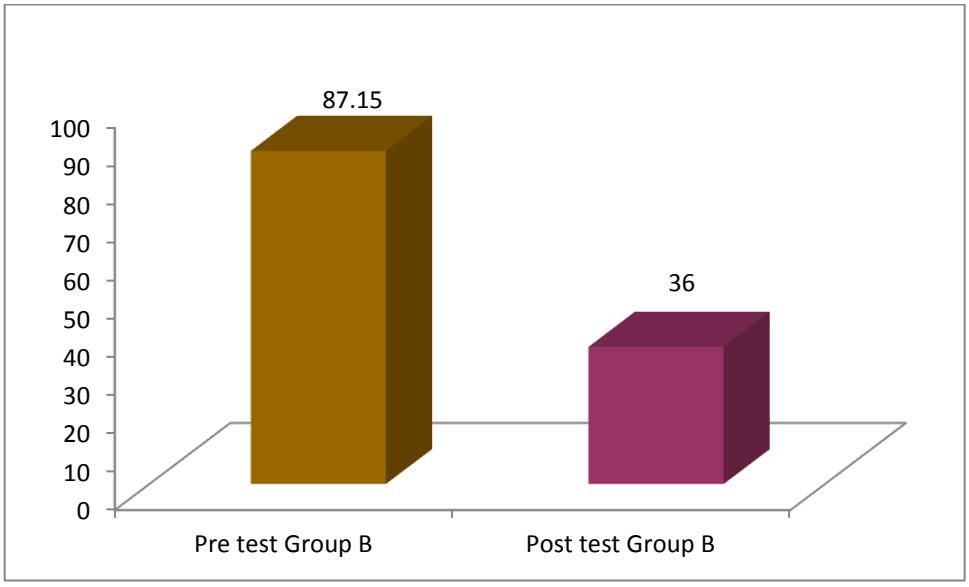


TABLE -V

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF FLEXION IN GROUP A – GONIOMETER (Paired 't' test)

S.N	Group A	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	96.30	±38.65	1.75	10.44
2.	Post test	134.95		16.64	

The table V shows analysis of GONIOMETER on paired 't' test. The 't' value for Group A was 10.44 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –V

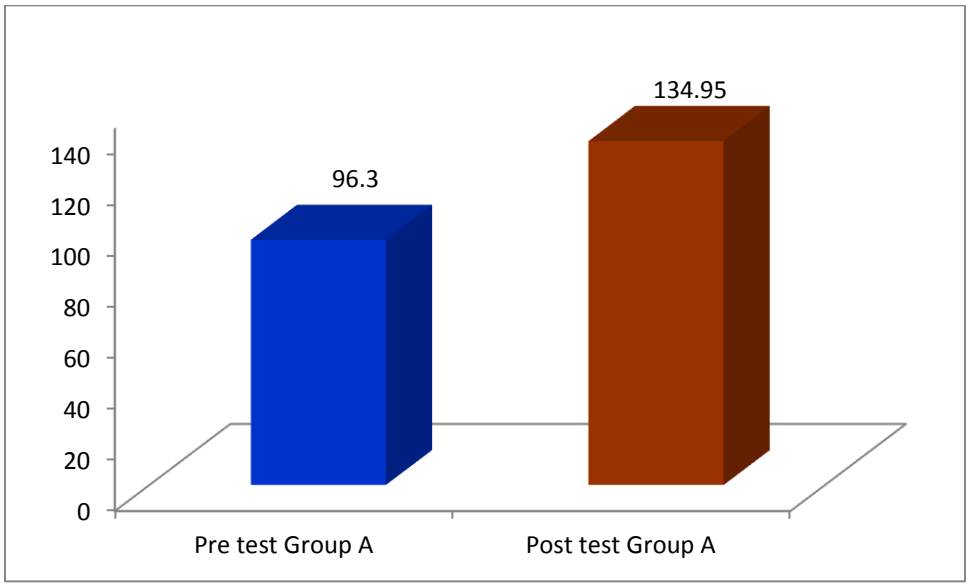


TABLE -VI

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF FLEXION GROUP B – GONIOMETER (Paired 't' test)

S.N	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	95.90	±13.00	1.89	10.16
2.	Post test	108.90		5.59	

The table VI shows analysis of GONIOMETER on paired 't' test. The 't' value for Group B was 10.16 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –VI

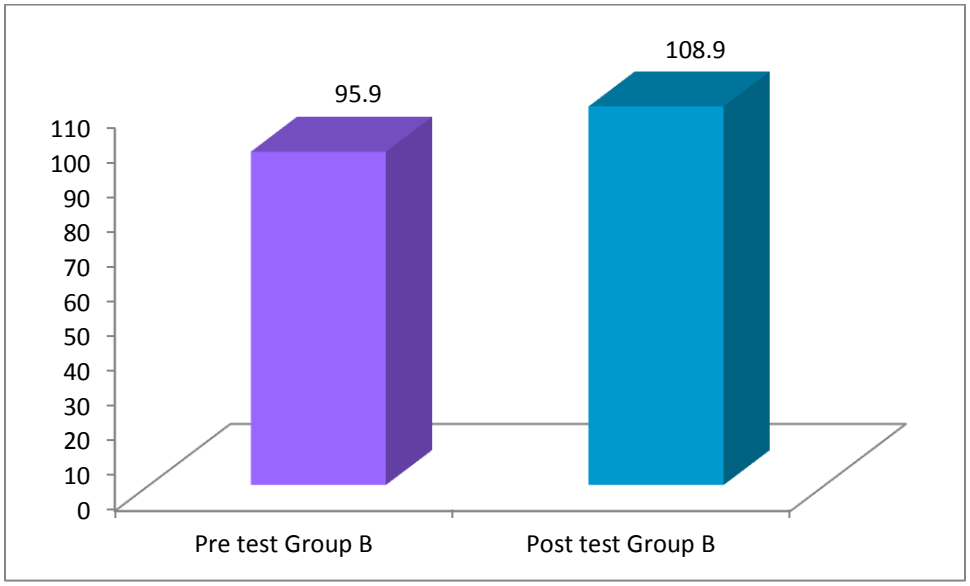


TABLE -VII

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF EXTENSION GROUP A – GONIOMETER (Paired 't' test)

S.N	Group A	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	42.90	±12.15	2.36	17.06
2.	Post test	55.05		2.68	

The table VII shows analysis of GONIOMETER on paired 't' test. The 't' value for Group A was 17.06 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –VII

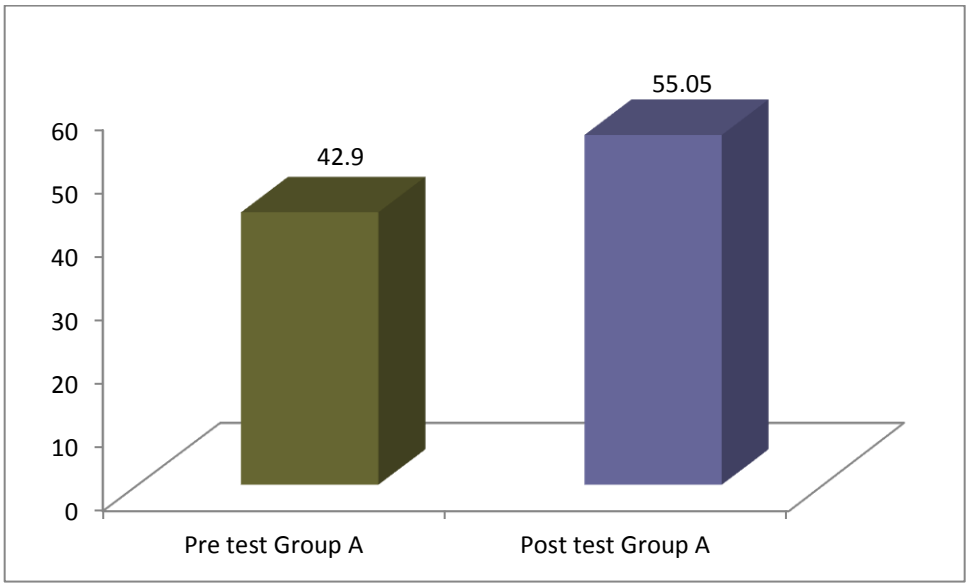


TABLE -VIII

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF EXTENSION GROUP B – GONIOMETER (Paired 't' test)

S.N	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	42.65	±3.15	2.28	7.764
2.	Post test	45.80		2.12	

The table VIII shows analysis of GONIOMETER on paired 't' test. The 't' value for Group B was 7.764 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –VIII

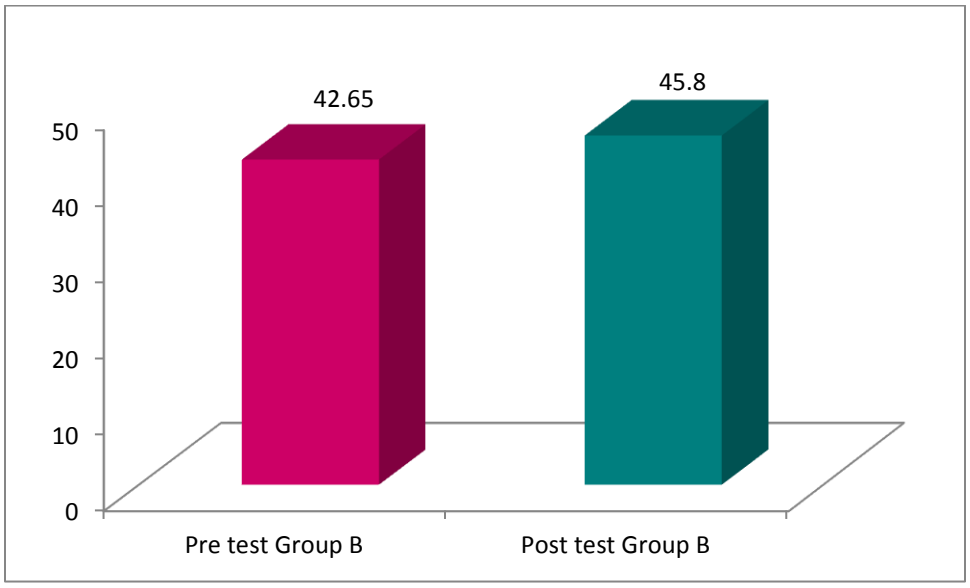


TABLE -IX

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF ABDUCTION IN GROUP A – GONIOMETER (Paired 't' test)

S.N	Group A	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	108.30	±39.80	9.03	10.90
2.	Post test	148.10		16.62	

The table IX shows analysis of GONIOMETER on paired 't' test. The 't' value for Group A was 10.90 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values

GRAPH –IX

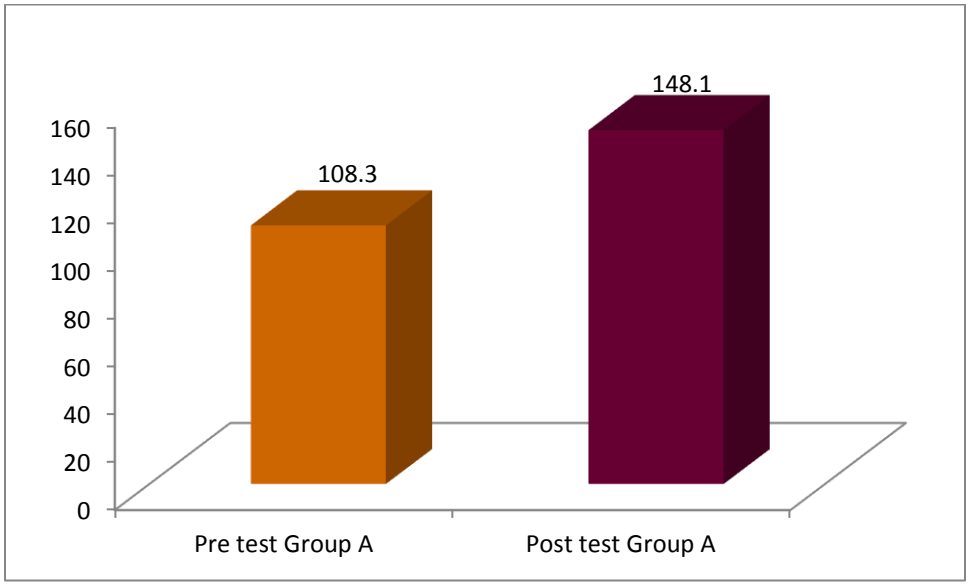


TABLE -X

COMPARISON BETWEEN THE PRE TEST AND POST TEST VALUES OF ABDUCTION IN GROUP B – GONIOMETER (Paired 't' test)

S.N	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	109.90	±6.95	9.03	10.18
2.	Post test	116.85		8.92	

The table X shows analysis of GONIOMETER on paired 't' test. The 't' value for Group B was 10.18 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –X

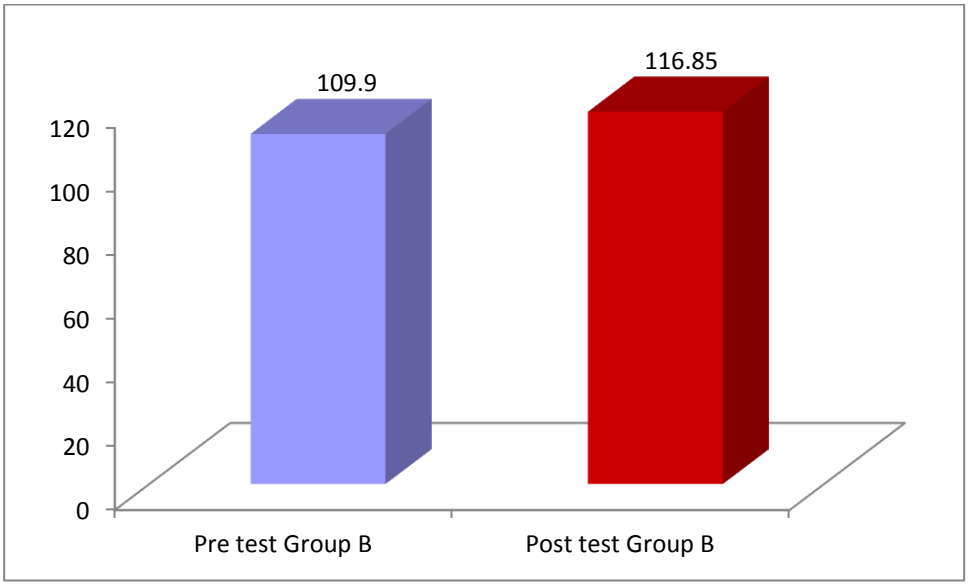


TABLE -XI

COMPARISON BETWEEN THE PRE TEST & POST TEST VALUES OF INTERNAL ROTATION IN GROUP A – GONIOMETER (Paired 't' test)

S.N	Group A	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	38.80	±16.00	4.44	12.54
2.	Post test	54.80		4.26	

The table XI shows analysis of GONIOMETER on paired 't' test. The 't' value for Group A was 12.54 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –XI

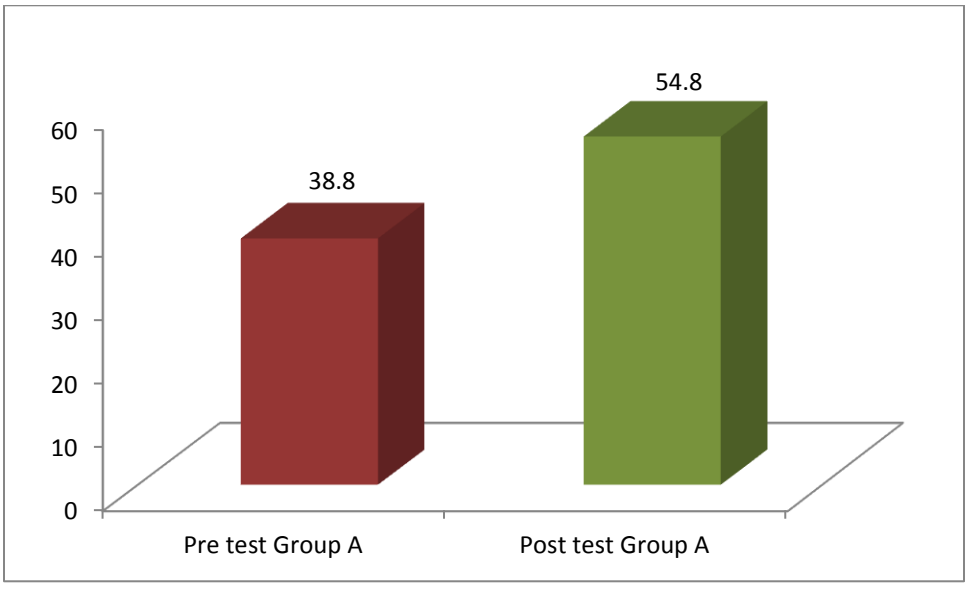


TABLE -XII

COMPARISON BETWEEN THE PRE TEST & POST TEST VALUES OF INTERNAL ROTATION IN GROUP B – GONIOMETER (Paired 't' test)

S.N	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	40.70	±4.10	3.64	10.33
2.	Post test	44.80		3.71	

The table XII shows analysis of GONIOMETER on paired 't' test. The 't' value for Group B was 10.33 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –XII

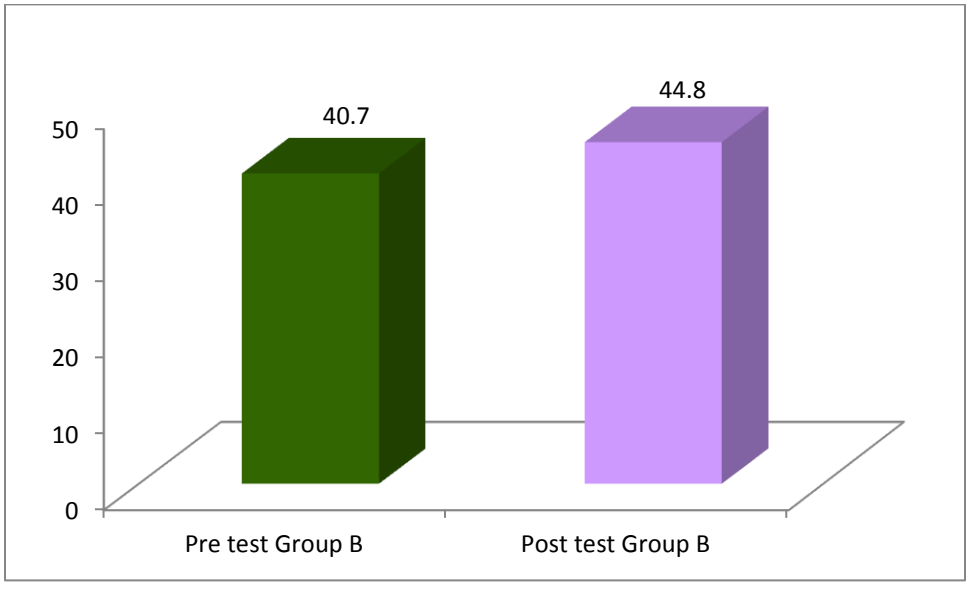


TABLE -XIII

COMPARISON BETWEEN THE PRE TEST & POST TEST VALUES OF EXTERNAL ROTATION IN GROUP A – GONIOMETER (Paired 't' test)

S.N	Group A	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	31.35	±37.25	5.90	17.73
2.	Post test	68.60		5.39	

The table XIII shows analysis of GONIOMETER on paired 't' test. The 't' value for Group A was 17.73 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –XIII

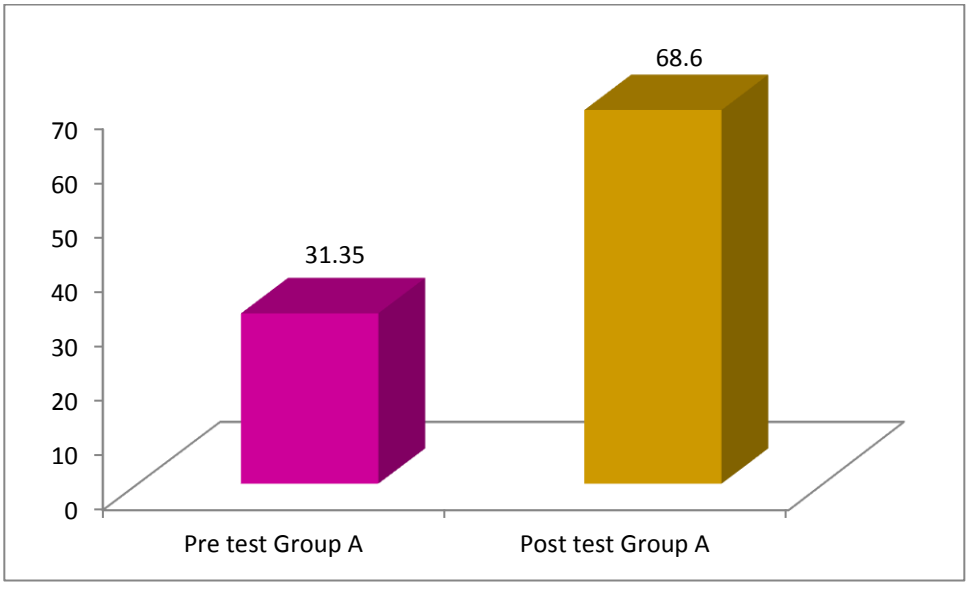


TABLE -XIV

COMPARISON BETWEEN THE PRE TEST & POST TEST VALUES OF EXTERNAL ROTATION IN GROUP B – GONIOMETER (Paired 't' test)

S.N	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre test	32.40	±8.30	5.25	13.20
2.	Post test	40.70		5.91	

The table XIV shows analysis of GONIOMETER on paired 't' test. The 't' value for Group B was 13.20 at 0.05% level of significance, which was greater than the tabulated 't' value 2.145. The result shows that there was marked difference between pre test and post test values.

GRAPH –XIV

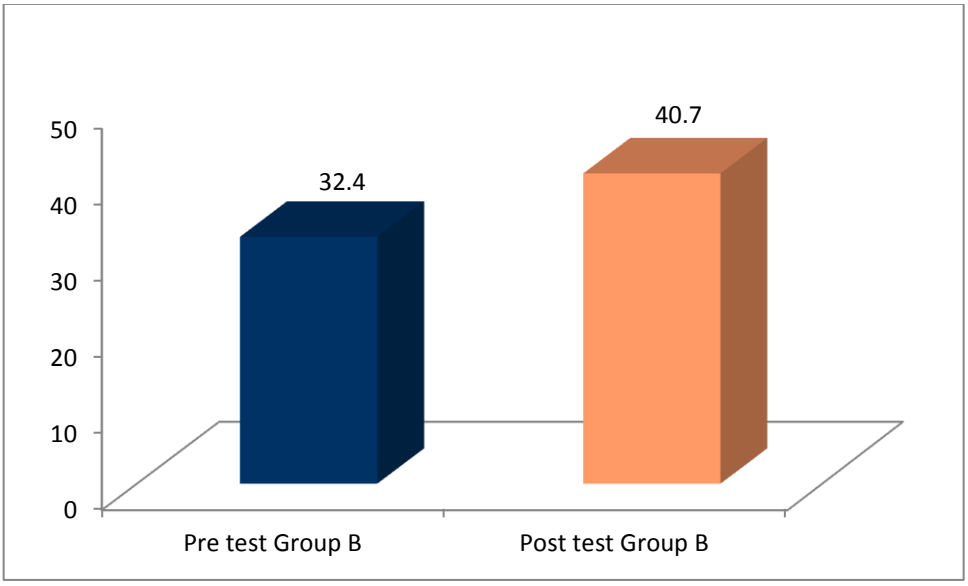


TABLE -XV

COMPARISON BETWEEN THE PRE TEST VALUES OF GROUP A AND GROUP B - VISUAL ANALOGUE SCALE (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	7.05	±0.20	0.83	0.7721
2.	Group B	6.85		0.81	

The table XV shows analysis of VAS on unpaired 't' test. The pre test value for Group A and Group B was 0.77 at 0.05% level of significance, which was lesser than the tabulated 't' value 2.048. The result shows that there was no marked difference between Group A and Group B.

GRAPH -XV

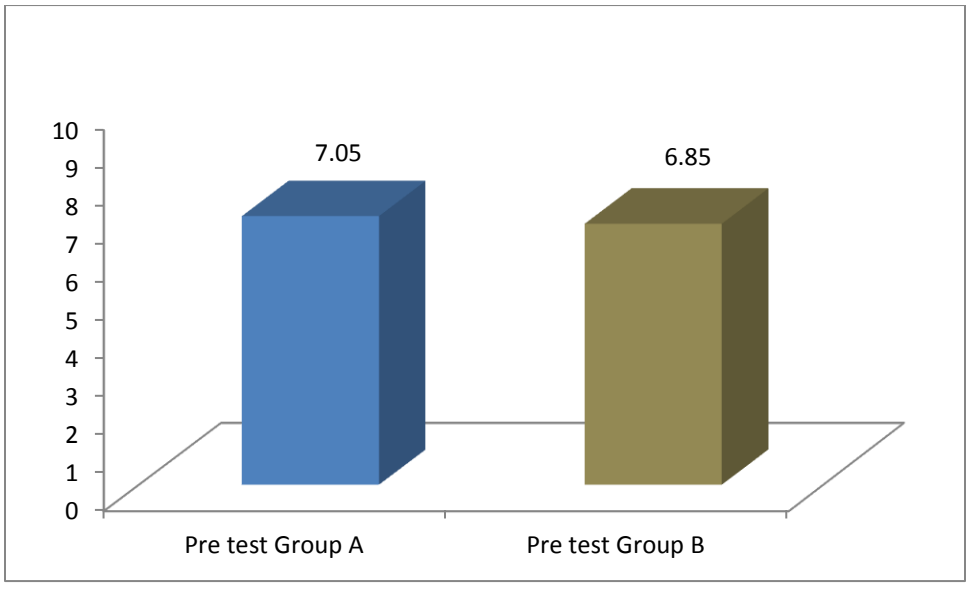


TABLE -XVI

COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B - VISUAL ANALOGUE SCALE (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	1.20	±2.50	0.83	8.697
2.	Group B	3.70		0.98	

The table XVI shows analysis of VAS on unpaired 't' test. The post test value for Group A and Group B was 8.697 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XVI

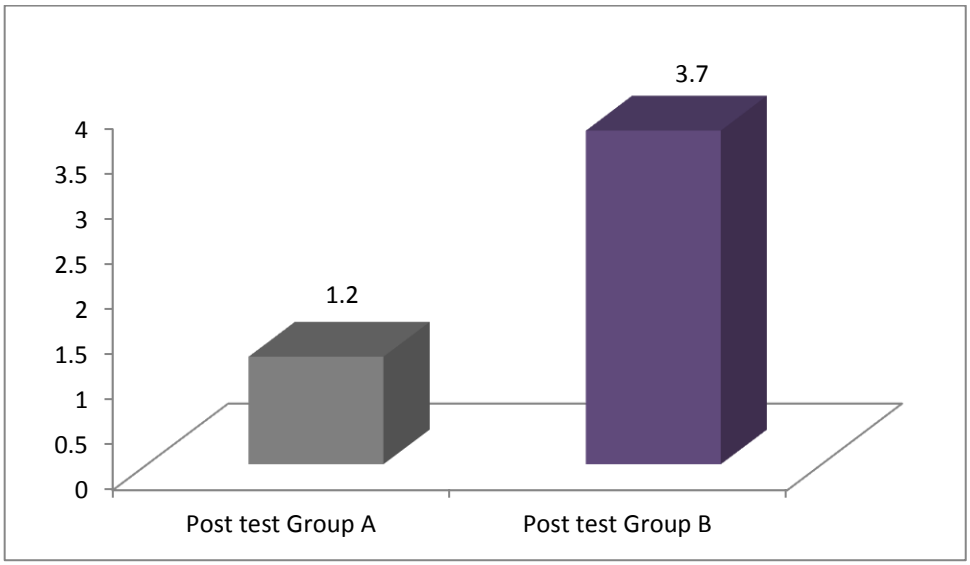


TABLE -XVII

COMPARISON BETWEEN THE PRE TEST VALUES OF GROUP A AND GROUP B - SPADI (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	86.65	±0.50	5.89	0.250
2.	Group B	87.15		6.70	

The table XVII shows analysis of SPADI on unpaired 't' test. The pre test value for Group A and Group B was 0.250 at 0.05% level of significance, which was lesser than the tabulated 't' value 2.048. The result shows that there was no marked difference between Group A and Group B.

GRAPH -XVII

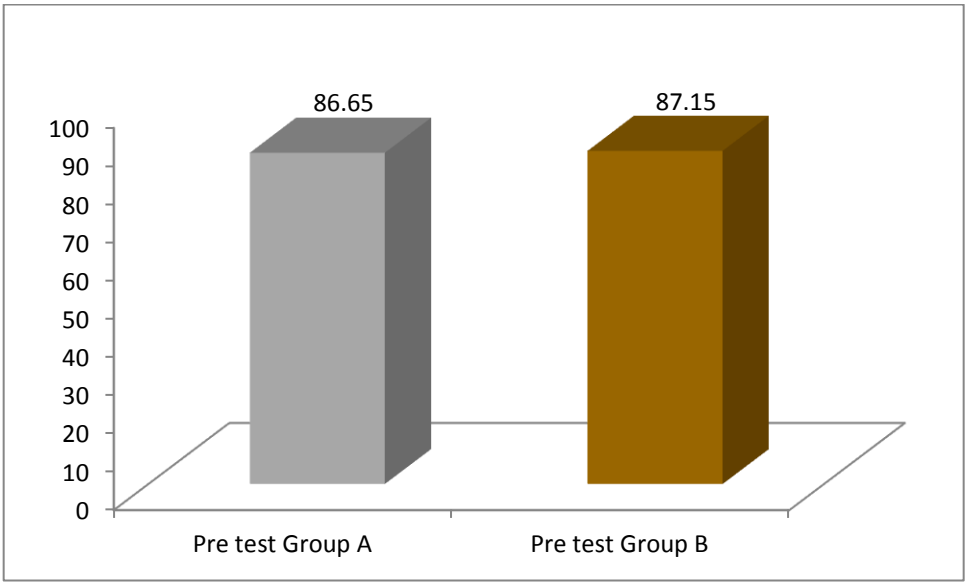


TABLE -XVIII

COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B - SPADI (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	12.50	±23.50	2.04	17.50
2.	Group B	36.00		5.65	

The table XVII shows analysis of SPADI on unpaired 't' test. The post test value for Group A and Group B was 17.50 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH –XVIII

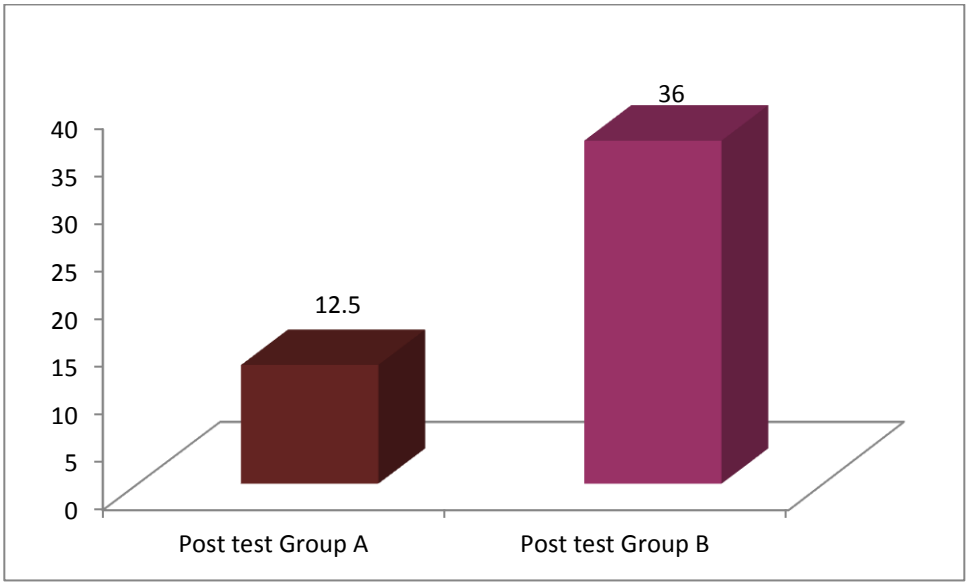


TABLE -XIX

COMPARISON BETWEEN THE PRE TEST VALUES OF FLEXION IN GROUP A AND GROUP B – GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	96.30	±0.40	1.75	0.694
2.	Group B	95.90		1.89	

The table XIX shows analysis of GONIOMETER on unpaired 't' test. The pre test value for Group A and Group B was 0.694 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XIX

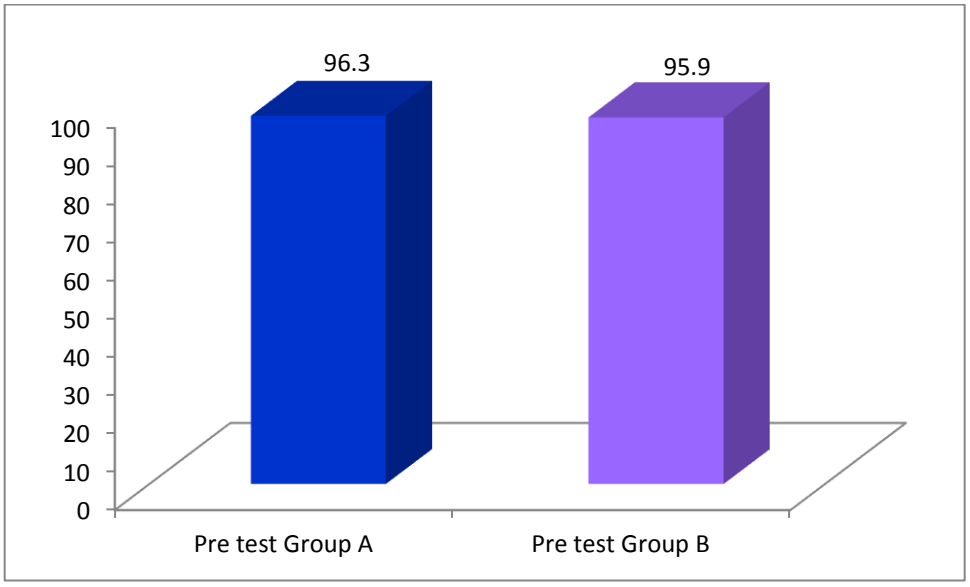


TABLE -XX

COMPARISON BETWEEN THE POST TEST VALUES OF FLEXION IN GROUP A AND GROUP B – GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	134.95	±26.05	16.64	6.637
2.	Group B	108.90		5.59	

The table XX shows analysis of GONIOMETER on unpaired 't' test. The post test value for Group A and Group B was 6.637 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH - XX

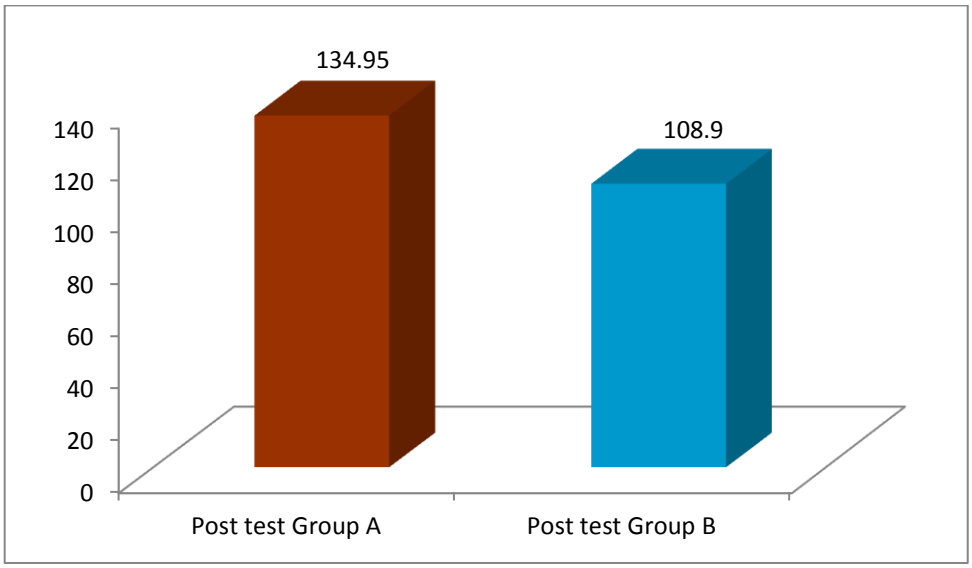


TABLE -XXI

COMPARISON BETWEEN THE PRE TEST VALUES OF EXTENSION GROUP A AND GROUP B – GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	42.90	±0.25	2.36	0.340
2.	Group B	42.65		2.28	

The table XXI shows analysis of GONIOMETER on unpaired 't' test. The pre test value for Group A and Group B was 0.340 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXI

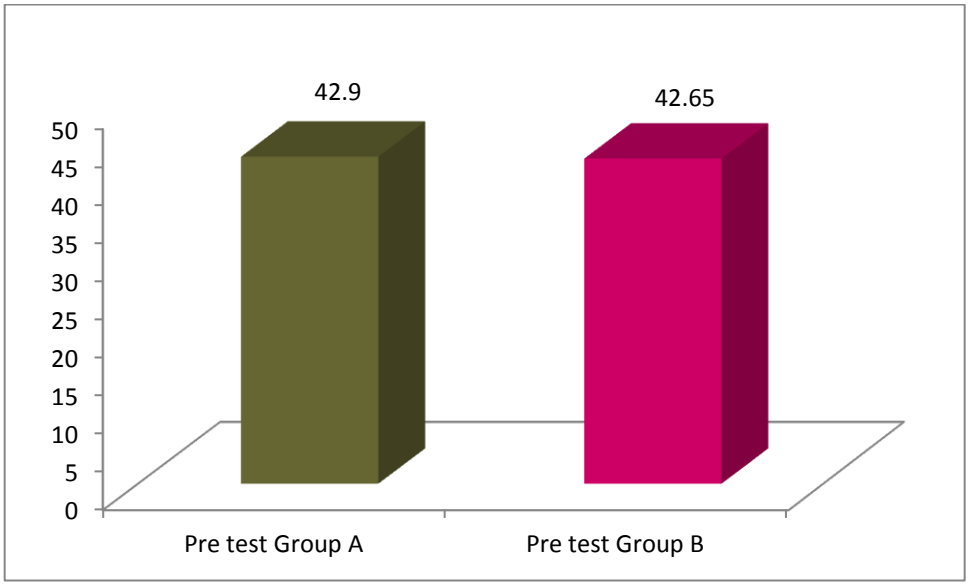


TABLE -XXII

COMPARISON BETWEEN THE POST TEST VALUES OF EXTENSION IN GROUP A AND GROUP B – GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	55.05	±9.25	2.68	12.097
2.	Group B	45.80		2.12	

The table XXII shows analysis of GONIOMETER on unpaired 't' test. The post test value for Group A and Group B was 12.097 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXII

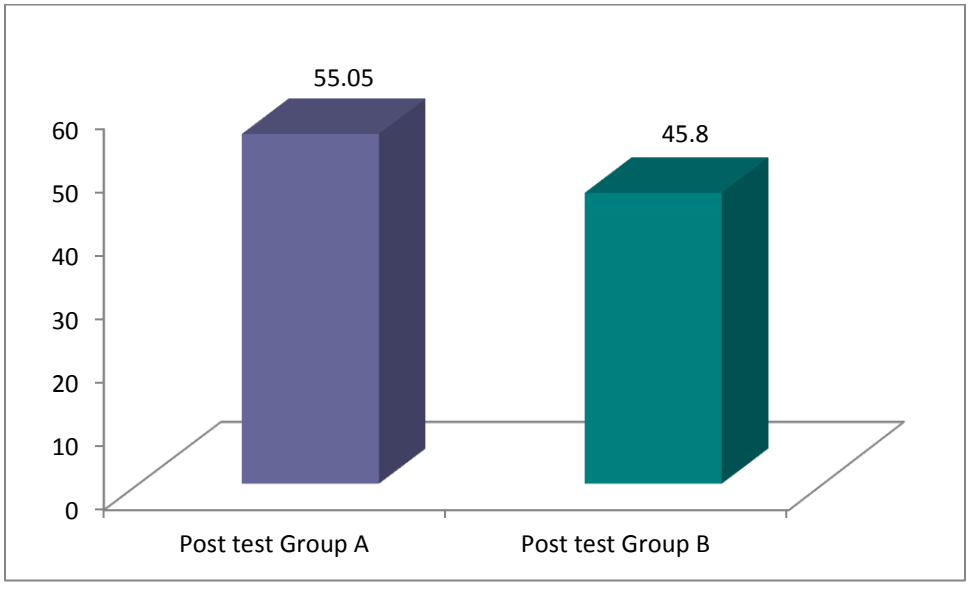


TABLE -XXIII

COMPARISON BETWEEN THE PRE TEST VALUES OF ABDUCTION GROUP A AND GROUP B – GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	108.30	±1.55	9.03	0.541
2.	Group B	109.85		9.06	

The table XXIII shows analysis of GONIOMETER on unpaired 't' test. The pre test value for Group A and Group B was 0.541 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXIII

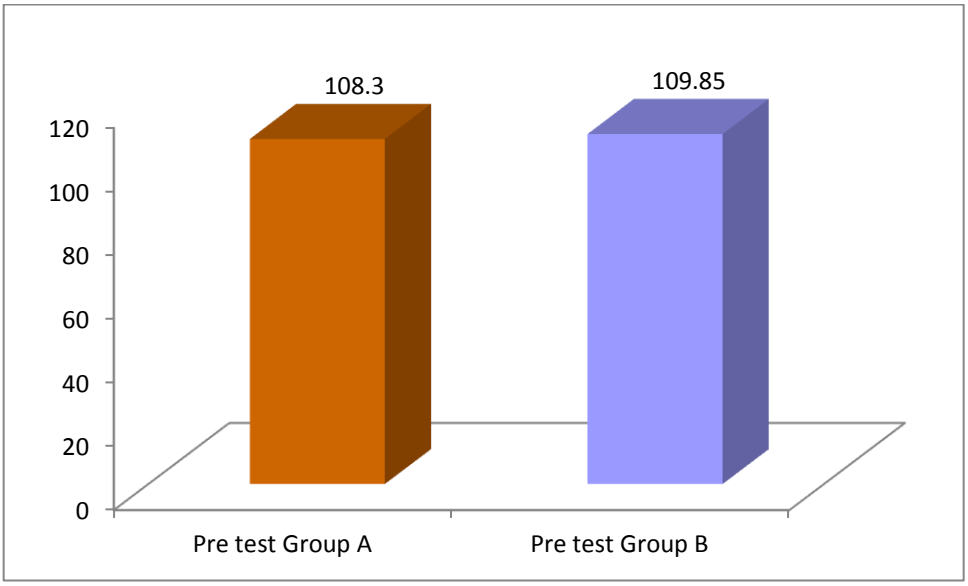


TABLE -XXIV

COMPARISON BETWEEN THE POST TEST VALUES OF ABDUCTION IN GROUP A AND GROUP B – GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	149.40	±32.55	14.72	8.455
2.	Group B	116.85		8.92	

The table XXIV shows analysis of ROM on unpaired 't' test. The post test value for Group A and Group B was 8.455 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXIV

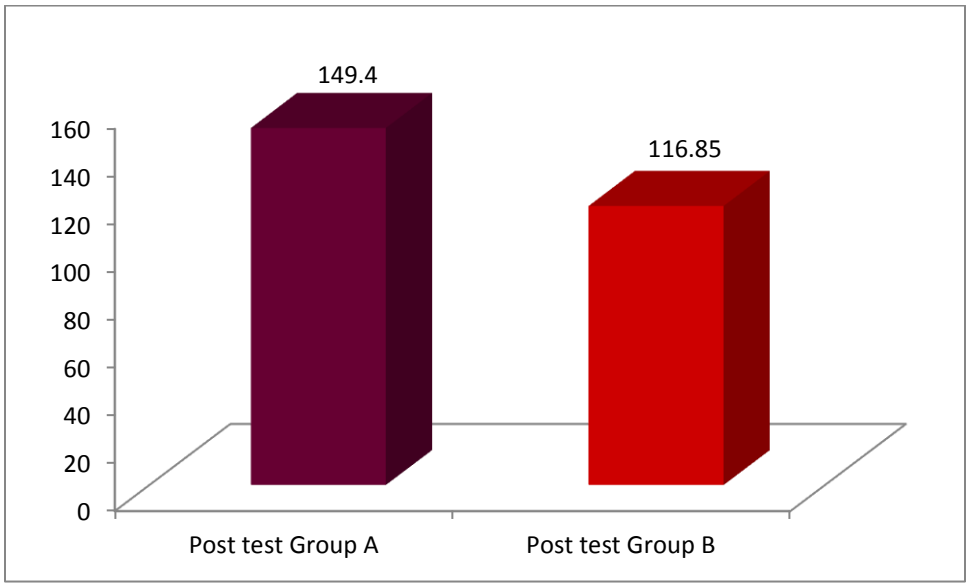


TABLE -XXV

COMPARISON BETWEEN THE PRE TEST VALUES OF INTERNAL POTATION IN GROUP A & GROUP B– GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	38.80	±1.90	4.44	1.478
2.	Group B	40.70		3.64	

The table XIX shows analysis of ROM on unpaired 't' test. The pre test value for Group A and Group B was 1.478 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXV

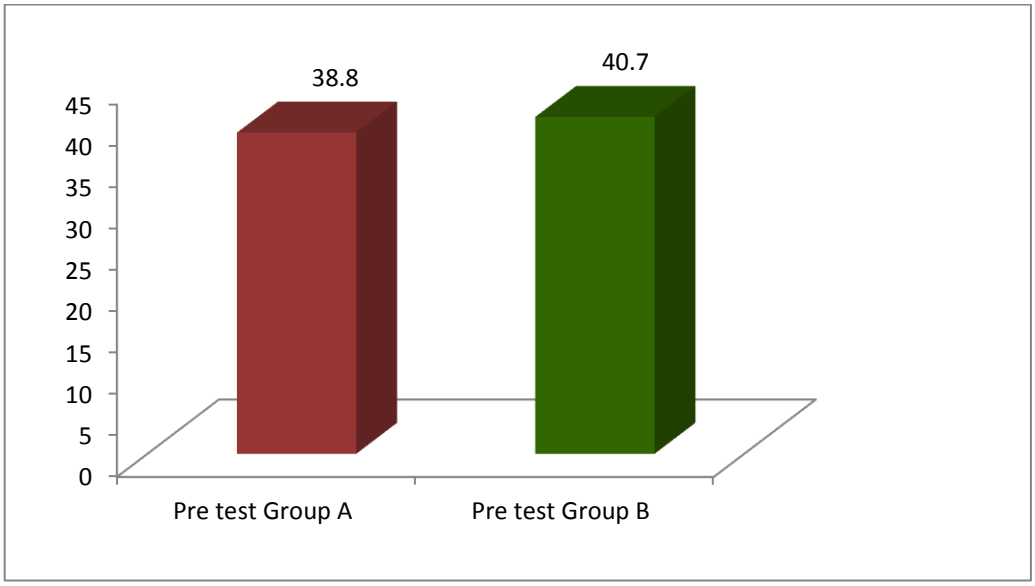


TABLE -XXVI

COMPARISON BETWEEN THE POST TEST VALUES OF INTERNAL ROTATION INGROUP A & GROUP B– GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	54.80	±10.00	4.26	7.916
2.	Group B	44.80		3.71	

The table XXVI shows analysis of GONIOMETER on unpaired 't' test. The post test value for Group A and Group B was 7.916 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXVI

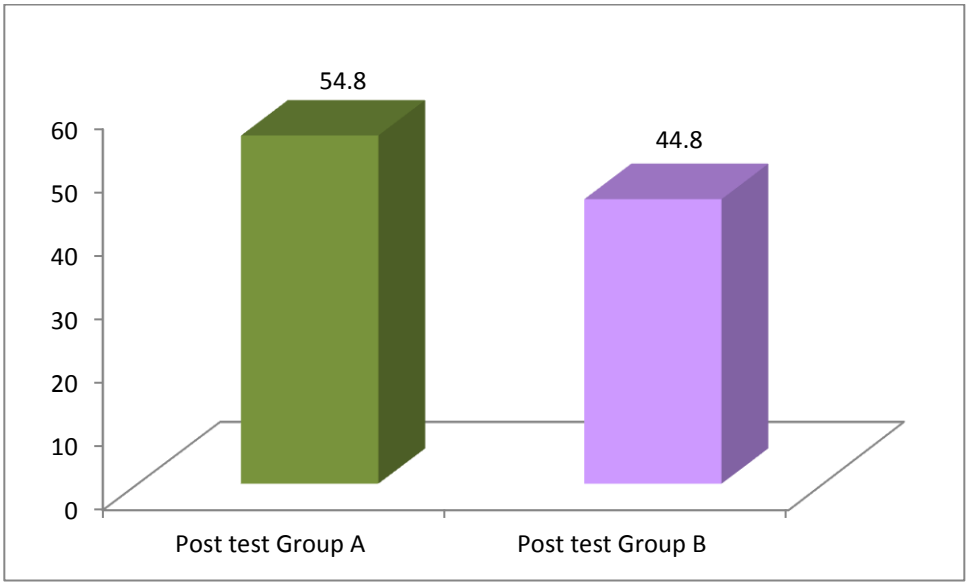


TABLE -XXVII

COMPARISON BETWEEN THE PRE TEST VALUES OF EXTERNAL ROTATION IN GROUP A & GROUP B– GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	31.35	±1.05	5.90	0.595
2.	Group B	32.40		5.25	

The table XXVII shows analysis of GONIOMETER on unpaired 't' test. The pre test value for Group A and Group B was 0.595 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXVII

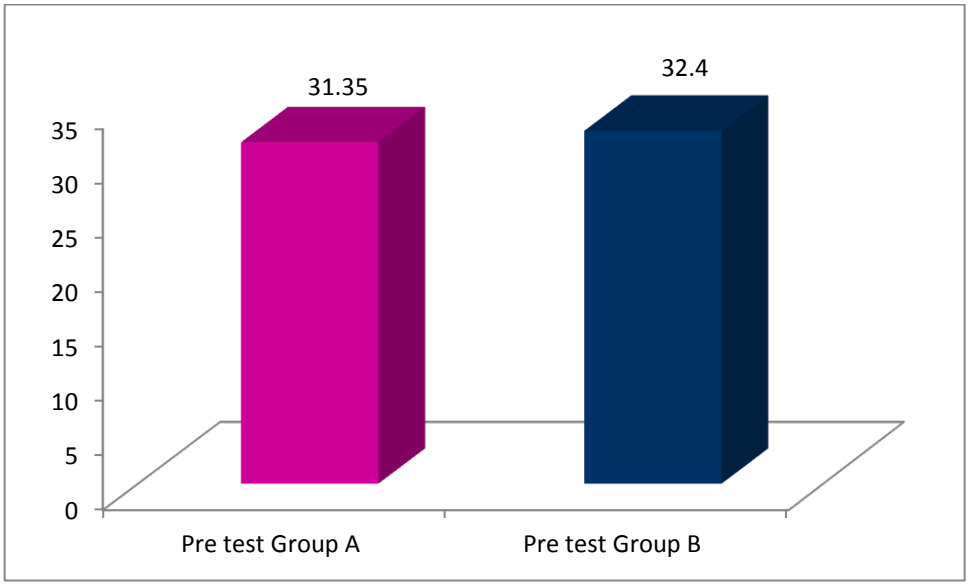


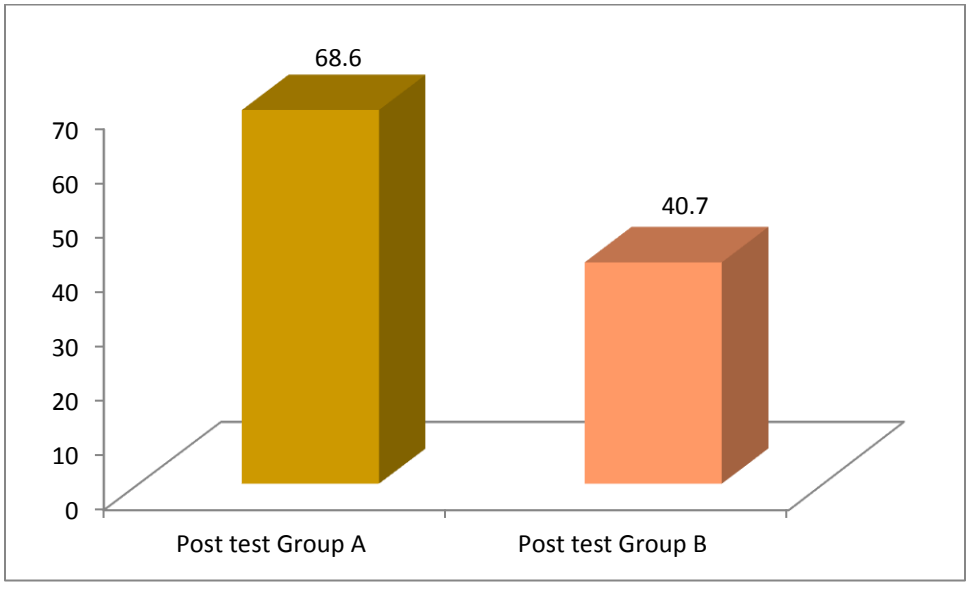
TABLE -XXVIII

COMPARISON BETWEEN THE POST TEST VALUES OF EXTERNAL ROTATION IN GROUP A & GROUP B– GONIOMETER (Unpaired 't' test)

S.N	Groups	Mean	Mean Difference	Standard Deviation	Un paired 't' Value
1.	Group A	68.60	±27.90	5.39	15.59
2.	Group B	40.70		5.91	

The table XXVIII shows analysis of ROM on unpaired 't' test. The post test value for Group A and Group B was 15.59 at 0.05% level of significance, which was greater than the tabulated 't' value 2.048. The result shows that there was marked difference between Group A and Group B.

GRAPH -XXVIII



RESULT

The paired ‘t’ test analysis for the pre test and post test variable for the visual analogue scale for measuring pain in patients with adhesive capsulitis which was shown in the table I & II

Both the groups show significant differences in the pre test and post test values. The ‘t’ value for the group A is 24.0145 , the value for the group B is 16.0980.

The unpaired ‘t’ test analysis for the post test variables for the both group for visual analog scale for measuring pain in patients with adhesive capsulitis is shown in the table XVI. There was a significant difference shown between the Groups. Subjects in Group A show superior mean difference than Group B. The ‘t’ value for the post test variables for both group is 8.6970.

The paired ‘t’ test analysis for the pre test and post test variables for the shoulder pain and disability index for measuring disability in patients with adhesive capsulitis which was shown in table III & IV.

Both the group show significant differences in the pre test and post test values. The ‘t’ value for the Group A is 60.6204, the ‘t’ value for the Group B is 24.7689.

The unpaired ‘t’ test analysis for the post test variables for the both group for shoulder pain and disability index scale for measuring disability in patients with

adhesive capsulitis is shown in the table XVIII. There was a significant difference shown between the Groups. Subjects in Group A show superior mean difference than group B. The ‘t’ value for the post test variables for both group is 17.5031.

The paired ‘t’ test analysis for the pre test and post test variable for the goniometer for measuring range of motion (flexion) in patients with adhesive capsulitis which was shown in the table V & VI.

Both the groups show significant differences in the pre test and post test values. The ‘t’ value for the group A is 10.4496, the value for the group B is 10.1611.

The unpaired ‘t’ test analysis for the post test variables for the both group for goniometer for measuring range of motion (flexion) in patients with adhesive capsulitis is shown in the table XX. There was a significant difference shown between the Groups. Subjects in Group A show superior mean difference than Group B. The ‘t’ value for the post test variables for both group is 6.6377.

The paired ‘t’ test analysis for the pre test and post test variable for goniometer for measuring range of motion (Extension) in patients with adhesive capsulitis which was shown in the table VII & VIII .

Both the groups show significant differences in the pre test and post test values. The ‘t’ value for the group A is 17.0685, the value for the group B is 7.7641.

The unpaired ‘t’ test analysis for the post test variables for the both group for goniometer for measuring range of motion (Extension) in patients with adhesive capsulitis is shown in the table XXII. There was a significant difference shown between the Groups. Subjects in Group A show superior mean difference than Group B. The ‘t’ value for the post test variables for both group is12.0979.

The paired ‘t’ test analysis for the pre test and post test variable for the goniometer for measuring range of motion (Abduction) in patients with adhesive capsulitis which was shown in the table IX & X.

Both the groups show significant differences in the pre test and post test values. The ‘t’ value for the group A is 10.9077, the value for the group B is 10.1848.

The unpaired ‘t’ test analysis for the post test variables for the both group for goniometer for measuring range of motion (Abduction) in patients with adhesive capsulitis is shown in the table XXIV. There was a significant difference shown between the Groups. Subjects in Group A show superior mean difference than Group B. The ‘t’ value for the post test variables for both group is 8.4554.

The paired ‘t’ test analysis for the pre test and post test variable for the goniometer for measuring range of motion (Internal rotation) in patients with adhesive capsulitis which was shown in the table XI & XII.

Both the groups show significant differences in the pre test and post test values. The ‘t’ value for the group A is 12.5464 , the value for the group B is 10.3353.

The unpaired ‘t’ test analysis for the post test variables for the both group for goniometer for measuring range of motion (Internal rotation) in patients with adhesive capsulitis is shown in the table XXVI. There was a significant difference shown between the Groups. Subjects in Group A show superior mean difference than Group B. The ‘t’ value for the post test variables for both group is 7.9161.

The paired ‘t’ test analysis for the pre test and post test variable for the goniometer for measuring range of motion (External rotation) in patients with adhesive capsulitis which was shown in the table XIII & XIV.

Both the groups show significant differences in the pre test and post test values. The ‘t’ value for the group A is 17.7384, the value for the group B is 13.2019. The unpaired ‘t’ test analysis for the post test variables for the both group for goniometer for range of motion (External rotation) in patients with adhesive capsulitis is shown in the table XXVIII. There was a significant difference shown between the Groups. Subjects in Group A show superior mean difference than Group B. The ‘t’ value for the post test variables for both group is 15.5902.

VI DISCUSSION

The purpose of the study is to find out the effect of Muscle energy technique and Conservative exercises on pain, range of motion and shoulder function in adhesive capsulitis. 40 patients who complain of shoulder pain were diagnosed as adhesive capsulitis by the orthopedician were selected for the study using stratified sampling method. All were subjects were divided into two equal groups, 20 subjects in each group. Group A Subjects underwent Muscle energy technique for shoulder with Conservative exercises whereas Group B receives Conservative exercises.

Adhesive capsulitis has an incidence of 3–5% in the general population and up to 20% in those with diabetes. This disorder is one of the most common musculoskeletal problems seen in orthopedics. (Bridgman et al., 1972, Pal et al., 1986). Adhesive capsulitits has significant loss of its range of motion in all directions and severe pain around the shoulder. Despite many researches in the last century, the etiology and pathology of the Adhesive Capsulitis remains enigmatic (Wadsworth 1986). Most of cases the Frozen Shoulders is idiopathic (Primary), but some may be associated with certain factors such as diabetes Mellitus, Spinal Lesion, Trauma or Prolonged Immobilization of the shoulders for some other causes (secondary) (Jayson 1981).

The pathophysiology of FS continues to be largely mysterious. Adhesive capsulitis develops adaptive postural deviations such as anterior shoulders or increased thoracic kyphosis, resulting the shoulder complex as painful. It is generally related to a shortening and fibrosis of the joint capsule (ligaments) surrounding the shoulder joint. Nevasier was among the first to report thickening and contraction of the shoulder capsule as well as inflammatory changes through histologic analysis.(Ludewig& Reynolds, 2009). Studies report ranges of between 20 and 50% of patients with adhesive caspulitis which suffer long-term ROM deficits that may last up to 10 years (Binder et al., 1984, Schaffer et al., 1992).

The management of adhesive capsulitis often involves use of anti inflammatory drugs, corticosteroids and NSAIDs, these medications play a role in relieving symptoms. (Blockey et al., 1954, Kessel et al., 1981). Numerous studies have seemed the efficacy of rehabilitation following adhesive capsulitis. Most of these studies demonstrate various degrees of improvement in pain, ROM and function. (Schaffer et al., 1992, Diercks et al., 2004, Ekelund et al., 1992, Griggs et al., 2000). Physiotherapy is the most effective interventions for adhesive capsulitis (Ozaki et al., 1989 & Simmonds 1949), to reduce pain, increase range of motion & to regain the normal extensibility of the shoulder capsule, to regain the normal extensibility of the shoulder capsule, passive stretching of the shoulder capsule in all planes of motion by means of mobilization techniques has been recommended

(Mennel 1964, Maitland 1983 & Kaltenborn 1976). Non-aggressive physical therapy interventions are generally more effective than aggressive or intensive interventions (Roubal et al., 1996).

In this study the subjects in Group A, Subjects underwent muscle energy technique with Conservative exercises for duration of six weeks. Following the treatment, their pre test values and the post test values were calculated and analyzed for the results. Adding the Muscle energy technique along with Conservative exercises demonstrate a significant reduction in pain, improvement in range of motion and functional disability. (Lokesh et al., 2015) which show a similar result to our study.

Muscle energy technique is known for its hypoalgesic effect. The muscle relaxation is mediated by afferent input from the golgi tendon organ when the muscle is held in an isometric contraction, the afferent feedback leads to inhibition of the muscle which help in relaxation of the muscle when the cessation of the contraction. (Lisi et al., 2002).

Muscle energy technique was much effective in increasing the ROM based on physiological mechanisms behind the changes in muscle extensibility. MET can be used to lengthen shortened musculature and improve joint function and range of motion. The combination of contractions and stretching (post isometric relaxation)

used in MET would be more effective for producing greater viscoelastic change and passive extensibility than passive stretching alone (Mahajan et al., 2012).

Study done by Ian Johnson 2001, concludes that there is an increase of ROM and decrease of disability following application of post isometric muscle relaxation. This study also gives additional support to the present study and shows that muscle energy technique with Conservative exercises play a major role in alleviating the symptoms of adhesive capsulitis.

Group B subjects underwent Conservative exercises for duration of six weeks. Following the treatment, their pre test values and the post test values were calculated and analyzed for the results.

Conservative exercises for the shoulder include AP glides, Codman's exercises, pulley exercises and capsular stretches. Mobilization of the shoulder joint provides significant improvement in the joint range of motion as well as pain measures. (Bulgen et al., 1982). Studies has identified that the joint mobilization has produced significant improvement in ROM, Pain and Joint volume. (Yang et al., 2007, Vermeulen et al., 2000, Johnson et al., 2007).

Stretching and strengthening exercises are influenced to reduce pain and it also improves the ROM (Kivimäki et al, 2007, Griggs et al 2000, Levine et al., 2007) More recently concluded that patients with phase-II idiopathic AC can be treated successfully with shoulder-stretching exercises program. Furthermore

stretching exercises should be continued for three months, after that more aggressive physiotherapy or invasive management should be considered.

Codman's pendulum exercises are the common exercises prescribed for any shoulder pathology. It produce grade I & grade II distraction and oscillation which result in decrease pain, increase flow of nutrients into the joint space and helps in early joint mobilization. (Codman 1934, Kisner et al., 1996). Codman suggest that adding weight to the pendulum exercises has produce distraction to the shoulder and thereby increase joint space.

Based on the statistical analysis the result of the study shows that the muscle energy technique with Conservative exercises has shown remarkable reduction of pain and improvement in range of motion and shoulder function, than in the group underwent Conservative exercises for adhesive capsulitis.

VII SUMMARY & CONCLUSION

SUMMARY

The purpose of the study is to find out the effect of Muscle energy technique and Conservative exercises on pain, range of motion and shoulder function in adhesive capsulitis.

40 patients who complain of shoulder pain were selected for the study following stratified sampling method. All were selected following inclusion and exclusion criteria. A detailed examination was done by orthopedic surgeon and senior physiotherapists for the inclusion of the participants for the study. After a clear explanation to the patients, those who are willing were selected and randomly assigned into two equal groups.

All subjects were divided into two equal groups, 20 subjects in each group. Group A Subjects underwent Muscle energy technique for shoulder with Conservative exercises whereas Group B receives Conservative exercises. Following the 6 weeks of interventions the outcome were measured pain was measured using visual analog scale, Range of motion using goniometer and shoulder function was assessed using SPADI.

Student ‘t’ test was used to find the difference between the pre-test outcome as well as the difference between the two groups. Based on this statistical analysis

the Group A patients showed a marked reduction in pain, improvement in range of motion and improvement in shoulder function when compared to the Group B.

CONCLUSION

1. There is a significant reduction of pain in both the groups.
2. There is a significant improvement of Range of motion in both the groups.
3. There is a significant improvement of Shoulder function in both the groups.
4. When compared between the Group A and Group B on pain, the Group A (Experimental group) shows a Significant reduction in pain.
5. When compared between the Group A and Group B on Range of motion, the Group A (Experimental group) shows a Significant improvement in Range of motion.
6. When compared between the Group A and Group B on shoulder function, the Group A (Experimental group) shows a significant improvement in shoulder function.

So this study concludes that the following application of Muscle energy technique with Conservative exercises there was a significant change in pain, range of motion and shoulder function when compared with Conservative exercises alone.

VIII LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS

- Study was done with combination of METs and Conservative, so the effect may overlap, further studies need to be done only with MET to find out its effect.
- Diabetic subjects not included in the study.
- Study not to differentiate between the primary and secondary adhesive capsulitis.
- Study not focused on various occupational
- Inter rater and Intra rater reliability for the range of motion was not analyzed
- Certain factors like Medications, Life style, sleeping pattern are not controlled.

RECOMMENDATIONS

- Further this study can be elaborate with a large group of people
- Secondary adhesive capsulitis can be considered in futures study
- Further analysis in the same study can be done like age group and gender analysis.
- Future study can be done with various types of manual therapy.

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APPENDIX I

MUSCLE ENERGY TECHNIQUE

GROUP A- MUSCLE ENERGY TECHNIQUE

Muscle energy technique (Post isometric relaxation -PIS)

Muscle energy technique is applied for 5 repetition per set, 5 sets per session, Each repetation is maintained for 10 seconds.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER FLEXION:

Therapist should stand infront of the patient and placed one hand over the top of the patient's involved shoulder at the superior part of the scapula and cup the glenohumeral joint to palpate for motion. The other hand and forearm support the patient's flexed elbow and flexed the humerus at the glenohumeral joint in the sagittal plane up to the initial point of resistance. The patients are directed to extend the elbow against equal counterforce applied by the therapist.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER EXTENSION:

Therapist should stand in front of the patients and placed one hand over the top of the patient's involved shoulder at the superior part of the scapula and cups the glenohumeral joint to palpate for motion. Place the other hand to support patient's flexed elbow and directed the patient to push the elbow anteriorly.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER ABDUCTION:

Therapist should stand in front of the patient, placed one hand over the top of patient's involved shoulder, cups the glenohumeral joint to palpate for motion and directed the patients to press the elbow towards their body.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER INTERNAL ROTATION:

Therapist stood facing the patient. Carefully place the dorsum of the patient's hand of the involved side against the patients back. Therapist placed his one hand over the top of shoulder and superior part of the scapula and other palm protecting anterior side of the shoulder capsule and then placed his other hand, posterior to the patient's flexed elbow. Directed the patient to "press their elbow against his fingers.

MUSCLE ENERGY TECHNIQUE FOR SHOULDER EXTERNAL ROTATION:

Therapist should stand behind the patient. Placed his hand superior to the patient's involved glenohumeral joint. Placed his forearm of the other hand medial to the patient's flexed forearm with his hand supporting the patient's hand and the wrist and then directed the patients to internally rotate the arm by pressing the hand.

APPENDIX II

CONSERVATIVE EXERCISES

Codman's (pendulum) Exercises

Bend forward at the waist, (back parallel to ground is ideal). Allow involved arm to hang down, perpendicular to the floor. Keep arm and shoulder muscles relaxed. Move arm slowly, increasing the arc as tolerated. This technique should cause only minimal pain.

- Front to back
- Side to side
- Clockwise circles
- Counterclockwise circles

Pulley exercise

Capsular stretches- Anterior capsule, Posterior capsule, Inferior capsule,

Hold the stretch for 30 seconds for each repetitions

Anterior Capsule Stretch

Stand parallel to a doorway or pole, so it is in line with your right shoulder. Stand with your feet hip-width, toes pointing forward or turned slightly outwards, with arms by your sides. Engage your abdominal muscles to stabilize your spine.

Pull your shoulder blades down and back. Do not allow the back to arch. Keep your chest lifted and chin tipped up slightly.

Bend your right elbow to 90 degrees and place your right forearm on the surface (door jam or pole). Slowly shift your gaze over your left shoulder, drawing the left shoulder slightly back to feel stretch.. Hold the stretch for 30 seconds.

Posterior Capsule Stretch

Stand parallel to a doorway or pole, so it is in line with your right shoulder. Stand with your feet hip-width, toes pointing forward or turned slightly outwards, with arms by your sides. Engage your abdominal muscles to stabilize your spine. Pull your shoulder blades down and back. Do not allow the back to arch. Keep your chest lifted and chin tipped up slight. Extend your right arm directly in front of you, palm facing up. Place your left hand under your right elbow and bring your right arm across the front of the body. Hold the stretch for 30 seconds.

Inferior Capsule Stretch

Stand with your feet hip-width, toes pointing forward or turned slightly outwards, with arms by your sides. Engage your abdominal muscles to stabilize your spine. Pull your shoulder blades down and back. Do not allow the back to arch. Keep your chest lifted and chin tipped up slightly. Reach your right arm to the ceiling keeping your shoulder down and away from your ears. Bend the right

elbow. Let your right hand drop to the middle of your back with your palm facing your back. Reach your left hand to the ceiling and place your fingers on your right arm, just above the elbow, applying light pressure to deepen the stretch.

APPENDIX III

MOBILIZATION

Definition:

Mobilization is a passive, skilled manual therapy technique applied to joints and related soft tissues at varying speeds and Amplitudes using physiological or accessory motion's for therapeutic purposes. – Guide to Physical Therapy Practice, APTA 2001.

ArthroKinematics:

Movement between joint surfaces also called as Accessory motions or joint play, This includes Roll, Glide / Slide and spin. [Kaltenborn, 1980]

Convex Concave Rule:

When the concave surface moves on a fixed convex surface, the concave articulating surface moves in the same direction as the bony lever.

When the convex surface is moving on a fixed concave surface, the convex surface moves in a direction opposite to the direction of the shaft of bony lever.

Glenohumeral joint:

Convex Surface: Humerus

Concave Surface: Glenoid

Loose Packed Position (Resting position): 55-70 Abduction 30 horizontal adduction, neutral rotation.

Close Packed Position: Maximum abduction and External rotation.

Treatment Plane: In glenoid fossa in Scapular Plane.

Grades of Mobilization – Maitland Grades of Oscillation technique Dossages:

- Grade I: Small – amplitude rhythmic oscillations are performed at the beginning of the range.
- Grade II: Large – amplitude rhythmic oscillations are performed with in the range, not reaching the limit.
- Grade III: Large – amplitude rhythmic oscillations are performed up to the limit of the available motion and are stressed into the tissue resistance.
- Grade IV: Small – amplitude rhythmic oscillations are performed at the limit of the available motion and stressed in to the tissue resistance.
- Grade V: A Small – amplitude, high velocity thrust technique is performed to snap adhesions at the limit of the available motion.

Uses

Grade I & II : To reduce pain

Grade III & IV: To reduce stiffness and improve range of motion

Techniques of Shoulder Glide Mobilization

Posterior glide also applied in supine position with the arm kept in resting position. The therapist stands with his back to the patient between the patient's trunk and arm and grasps the distal humerus with the lateral hand. This position provides a grade I distraction to the joint. The lateral border of the other hand is kept just distal to the anterior joint margin and the humerus is glided posteriorly.

Anterior glide is applied in porn position with the arm kept in resting position over the edge of the couch. Stabilize the acromion with padding. The therapist stride stands facing the top of the couch. The arm is stabilized on the therapist's thigh and provides a grade I distraction to the joint. The ulnar border of the closer hand is placed just distal to the posterior angle of the acromion process, with the fingers facing posteriorly. With this hand apply a mobilizing force anteriorly and slightly medially.

Inferior glide is applied with the patient in supine position, with the arm abducted to the end of its available range. External rotation of the humerus is also added as

the arm approaches and goes beyond 90. The therapist stands facing the patient's foot and stabilizes the patient's arm against his trunk with one hand. This position provides a grade I distraction to the joint. The web space of the other hand is placed just distal to the acromion process on the proximal humerus. With this hand the humerus is glided in the inferior direction.

Joint distraction is applied with the patient in supine position.The patient's arm is kept in resting position and the forearm and the forearm is held between the trunk and elbow of the therapist. The therapist's hand which is closer to the patient is applied in the patient's axilla, with the thumb just distal to the joint margin and the fingers posteriorly. The other hand supports the distal humerus from the lateral side. With the hand in axilla the humerus is moved moved laterally.

Progression and change of technique can be added as required for the individual patient. The grade [I-IV] of stretch was largely dependent upon the patient's response and end-feel testing. For situations where pain or muscle spasm preceded a sensation of resistance, a grade I or II stretch was applied. As the end-feel became more resistant and less painful, grade III and IV pressure was applied.

APPENDIX IV

SHOULDER PAIN AND DISABILITY INDEX

Please place a mark on the line that best represents your experience during the last week attributable to your shoulder problem.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: 0 = no pain and 10 = the worst pain imaginable.

At its worst?	0	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	0	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	0	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	0	1	2	3	4	5	6	7	8	9	10

Total pain score _____ /50 x 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, e.g:. if 1 question missed divide by 40)

Disability scale

How much difficulty do you have?

Circle the number that best describes your experience where: 0 = no difficulty and 10 = so difficult it requires help

Washing your hair?	0	1	2	3	4	5	6	7	8	9	10
10 Washing your back?	0	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	0	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	0	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	0	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	0	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	0	1	2	3	4	5	6	7	8	9	10

Total disability score: _____/ 80 x 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, e.g:. if 1 question missed divide by 70)

Total Spadi score: _____/ 130 x 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, e.g: if 1 question missed divide by 120)

Minimum Detectable Change (90% confidence) = 13 points (Change less than this may be attributable to measurement error)

Source: Roach et al. (1991). Development of a shoulder pain and disability index.

APPENDIX V

VISUAL ANALOGUE SCALE

Visual analogue scale (VAS) is designed to present to the patient a rating scale with minimum constraints. Patient mark the location on 10- centimeter line corresponding to the amount of pain they experienced. This gives them the greatest freedom to choose their pain's exact intensity. It also gives the maximum opportunity for each patient to express a personal response style.

Visual Analogue Scale (VAS) data of this type is recorded as the number of millimeters from the left of the line with the range 0- 100.

0 10

No Pain **Intolerable Pain**

APPENDIX VI

UNIVERSAL GONIOMETER

Goniometer was used to measure Shoulder Range of motion. In this study Shoulder Flexion, Extension, Abduction, Internal Rotation and External Rotation was measured.

SHOULDER JOINT

PROCEDURE

FLEXION

Motion occurs in the sagital plane around frontal axis.

Patient Position:

Supine lying position

Stabilization:

Scapula stabilized to prevent upward and elevation of the scapula.

Goniometer Placement:

Axis: Placed 1 inch below the acromion process.

Immovable Arm: Placed parallel to trunk.

Movable Arm: Placed parallel to humerus.

Ask the patient to move in the direction of shoulder flexion (upwards), measuring active range.

EXTENSION

Motion occurs in the sagital plane around frontal axis.

Patient Position:

Prone lying position

Stabilization:

Scapula stabilized to prevent upward and elevation of the scapula.

Goniometer Placement:

Axis: Placed 1 inch below the acromion process.

Immovable Arm: Placed parallel to trunk.

Movable Arm: Placed parallel to humerus.

Ask the patient to move in the direction of shoulder extension (backwards), measuring active range.

ABDUCTION

Motion occurs in the frontal plane around anterior-posterior axis.

Patient Position:

Supine lying with palms of the hand faces anteriorly.

Stabilization:

Scapula stabilized to prevent upward and elevation of the scapula.

Goniometer Placement:

Axis: Anteriorly to the Acromion Process of the scapula.

Immovable Arm: Placed parallel to the midline of anterior aspect of the sternum.

Movable Arm: Placed along the axis of humerus.

Ask the patient to move in the direction of shoulder abduction (sideways), measuring active range.

INTERNAL ROTATION

Motion occurs in the transverse plane around vertical axis.

Position:

Supine lying at the edge of the couch, with the arm being tested in 90 degrees of Shoulder Abduction and the Elbow Flexion.

Stabilization:

Stabilize distal end of the humerus and scapula.

Goniometer Placement:

Axis: Olecranon Process of Ulna

Immovable Arm: vertically downwards parallel or perpendicular to the floor.

Movable Arm: Along the forearm (Ulna), using Olecranon Process and Ulna Styloid for reference.

Actively internal rotation is done by the patient and measured.

EXTERNAL ROTATION

Motion occurs in the transverse plane around vertical axis.

Position:

Supine lying at the edge of the couch, with the arm being tested in 90 degrees of Shoulder Abduction and the Elbow Flexion.

Stabilization:

Stabilize distal end of the humerus and scapula.

Goniometer Placement:

Axis: Olecranon Process of Ulna

Immovable Arm: vertically downwards parallel or perpendicular to the floor.

Movable Arm: Along the forearm (Ulna), using Olecranon Process and Ulna Styloid for reference.

Actively external rotation is done by the patient and measured.

APPENDIX –VII

PATIENT CONSENT FORM

I ……voluntarily consent to participate in the project named **"EFFECT OF MUSCLE ENERGY TECHNIQUE AND CONSERVATIVE EXERCISES ON PAIN, RANGE OF MOTION AND SHOULDER FUNCTION IN PATIENTS WITH ADHESIVE CAPSULITIS"**

The candidate has explained to me that treatment approach in brief, risk of participation and has answered the questions related to the study to my satisfaction.

Participant's Signature :

Signature of witness :

Signature of candidate :

Date :